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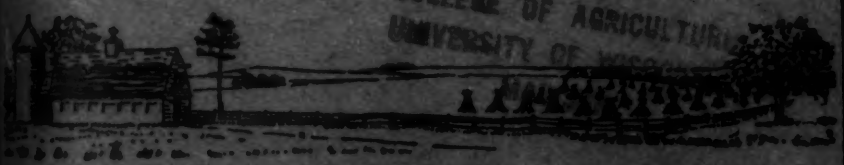

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The Farmer's Digest

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Grazing Management and Managed Pastures

Condensed from Guernsey Breeders' Journal

C. B. Bender

New Jersey Agricultural Experiment Station

CAN you get 15,000 lbs. of milk out of an acre of pasture? That is an interesting question. In fact, it is slightly staggering to the imagination. Let's see, 15,000 pounds of milk at today's market for Guernsey milk, roughly $6.00 per hundred, would be $900 income from an acre of pasture. That sounds like the ne plus ultra in feeding returns.

Now let's prospect this idea by a little pencil pushing and see how nebulous the idea really is.

First, a good piece of pastureland seeded down to a ladino clover, alfalfa brome grass seeding, or an orchard grass, ladino clover, alfalfa mixture, and fertilized well, can be extremely productive. In fact, in seasons of normal rainfall, yield figures in terms of green weight show that it is possible to produce 15-20 tons per acre. This is good, lush, palatable, nutritious herbage.

We must now examine this herbage for its nutrient content. One hundred pounds of this pasture will contain about five pounds of crude protein and 17 pounds of total digestible nutrients. Fifteen tons of the green material per acre means a production of 1,500 pounds of protein and 5,100 pounds of total digestible nutrients. Twenty tons of the green material would contain one ton of crude protein and 6,800 pounds of nutrients. These figures represent the protein content of 2½ tons of a 40 per cent protein concentrate and the nutrient content of 4½ tons of dairy feed.

Now take a Guernsey cow weighing 1,200 pounds and feed her the nutrients required to maintain her weight and produce 40 pounds of 5.0 per cent milk according to feeding standards.

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Let us feed grain and a little hay to meet her weight maintenance requirements. This would be met by a little less than nine pounds of grain and five pounds of hay. In order to produce the milk she would have to consume 89 pounds of pasture a day. That is not impossible.

Following this reasoning, if the nutrients in pasture would be used for milk production alone through good management, and the cows could harvest the pasture without any waste, which is impossible, then the 6,800 pounds of pasture nutrients could theoretically produce 18,230 pounds of 5.0 per cent milk per acre.

I don't believe anything is wrong with these figures. This milk potential is present in good pasture. It is up to us to exploit this potential as far as possible through good pasture management practices.

The first step in good pasture management is to have an abundance of good pasture for the entire grazing season. For every ton of pasture that the herd is short, either one ton of silage must be fed, of 700 pounds of hay, or 472 pounds of grain, to maintain production. Pasture is the cheapest feed that can be grown and every substitution that is made for it increases the cost of milk production.

A rotation grazing management program where different mixtures can be used on the plots, especially ones that have different maturity dates, make grazing management easier. For instance, a combination of tall oat grass and ladino clover can be grazed earlier than orchard grass and ladino clover. Brome grass and ladino clover or brome grass and alfalfa or ladino clover could be grazed next. The combinations with orchard grass, brome grass and alfalfa are quite heat and drought tolerant, so they will furnish fairly good midsummer grazing. A six-plot pasture system allowing five to six cows per acre is about the ideal system to manage. This will furnish some hay or grass silage as well as an abundance of pasture for most of the season. A supplemental plot of sudan grass is always good midsummer pasture insurance. Seeded June 1, it is usually ready for grazing by July 10-15. Seeded by the 15th of June, it would be ready by August 1. For late fall grazing and the earliest spring grazing, Balbo rye is close to the ideal plant. Seeded in August or early September it may be grazed once or twice late in the fall, depending on the section of the country and again in the early spring before other pastures are ready. This rye has the advantage over ordinary rye pasture in that it doesn't impart as much grassy flavor to the milk.

With tall oat or orchard grass-

ladino clover mixtures turn the cattle out when the grass is ready to graze. Don't wait until the clover is ready. If one waits for the clover, the grass will get too mature and the cattle will graze the clover instead of the grass. This is the best way to kill out a stand of ladino and have the grass dominate the stand. Manage each stand to the satisfaction of both the plants and the animals.

In turning out the milking herd temper the cows to the pasture. Don't put them on full pasture feed as soon as they are turned out. Allow them to graze an hour or an hour and a half the first day and then gradually extend the pasture time. This adjusts the animals to the pasture and at the same time eliminates a lot of complaints about grassy milk.

When the animals have been adjusted to the pasture and the weather is such that they can be turned out both day and night, then the next step in management should be made. Have hay racks placed at a point where the animals have to go to tank up on water.

If a pasture system is set up with a central watering place that services all plots, this is the ideal system. A half acre or an acre set aside as a combination loafing, watering and hay feeding lot is worth many dollars to the operator.

Pasture is the most valuable feed on the farm but there is something lacking in it from my observation. I believe whatever is lacking in the pasture is present in hay. I have seen cows and heifers on the best of pasture eat twigs and brush along the fence rows. I believe it is coarse dry matter they crave which possibly increases peristaltic action in the rumen. I do know when they have access to hay on the pasture they don't eat brush.

Since installing hay racks on our pastures I have had the opportunity of watching the grazing habits of the cows and their reaction to the hay. As soon as they were on full pasture feed day and night, the hay racks were filled. When the cows were turned out in the morning they would start grazing immediately. After getting a partial fill they would go down to the trough for water. After a drink they would munch some hay and then go back to the pasture. I have seen them go back for water and hay three times in an hour and a half, and graze each time on their return to the pasture.

At the conclusion of last season's work we found that the cattle relished well-cured hay in the racks, were not interested in partially cured hay, and they averaged an intake of about seven

pounds of hay a day. This was a lot more hay than we were able to get into them by holding them in the barn after milkings. Using this system of management the milking cows held ther flesh much better, maintained a steadier milk flow and consumed less grain.

In grazing any pasture it is inadvisable to allow the herd to graze the stand too closely. There are several reasons for this practice. First, close grazing allows too great a run off of water during a rain so it reduces the permeability of the water into the soil where it must go to stimulate renewal growth. Second, it will adversely affect the vigor of the stand because it does not allow the plants to build up root reserves. Third, there is no individual managing a herd of cattle on pasture who can tell when there is just enough pasture remaining to support one day of extra grazing. A good rule to follow is to look over the pasture and if you think there is enough grass to take care of the herd one more day, take them off at once. Don't put them out for that extra day.

With a crop as valuable as pasture, an operator can afford to spend some of his own time in keeping this crop as productive as possible. Mowing the pastures after the cows have taken the grass down is a valuable practice. Set the cutter bar for about a three-inch cut and go over the field. This tops off the grass grown on the polluted areas and also cuts down the weeds. This mowed grass will dry up and most of it will be consumed the next time the cattle are turned into the pasture.

The problem of pasture pollution by animal droppings is a perennial one. The best solution is to drag the pastures twice a year, once in midsummer and again after the animals have been removed at the end of the grazing season. A chain harrow or a spike tooth harrow does a satisfactory job. More frequent use of the harrows in any one season pollutes too large an area in a single season. The first grass grown on these polluted areas is usually refused by the animals unless they are starved into eating it. After the first growth has been mowed off, the animals will take the renewal growth.

A lot has been written about the great blue grass pastures. They have done a great job but the job they can do is limited under our climatic conditions. Just by way of comparison, last season we had as part of our management system at the College two, four-acre pastures, one a blue grass-white clover sod and the other a brome grass-ladino clover seeding. Under the same fertilization and grazing management program the blue grass

pasture carried .93 cows per acre for a 150-day grazing season, while the triple purpose seeding carried 1.75 cows per acre. That means almost twice as much income in favor of the ladino clover-brome grass combination.

There is a milk potential of between 15,000 and 20,000 pounds per acre on well managed, fertile, productive pastures. How close can your cows come to getting it out? That will depend on management and that is your problem.

Hormones Reduce Insect Damage

Condensed from Successful Farming

Niemen Hoveland

Chalk up another score for plant hormones, those handy chemicals already performing such far-apart chores as killing weeds and holding apples on trees. Now they're cutting down insect damage, gluing on blossoms so bugs can't blast them off!

So far, the insect-combating power of hormones has been harnessed to meet only one farm problem, but the principle involved may have wide application.

Here's the story.

Up in northwestern Wisconsin, growers of wax or "string" beans faced a mean situation. Too often the yields were poor because many of the buds, blossoms, and small pods fell off. Prospects of finding a simple remedy looked very dim because three villains seemed to be ganging up on the crop: insects, heat, and drouth. Insecticides had been tested, but they didn't do much good—at least, not the prewar materials on the market at the time.

A trio of University of Wisconsin men, E. H. Fisher, A. J. Riker, and T. C. Allen, went to work. They found a way to produce controllable laboratory "weather" that would make beans drop their plant parts. Then they tried caging one kind of insect at a time with the beans, and they tested the effect of 14 different hormones on these pests.

These lab tests showed the dropping of buds, blossoms, and small pods was much worse when bean plants were fed upon by the tarnished plant bug or Lygus bug, one of the suspected culprits.

Finally, the trials brought out that this injury to beans could be greatly reduced by dusting them with certain hormones. The best hormone was the same kind used to hold apples on trees; its correct but deservedly unpopular name is alphanapthalene acetic acid. Second-best was our weed-killing friend, 2,4-D—properly diluted to an extremely low concentration, of course.

Field trials proved the pay-off. Two-year tests in various locations showed yield boosts of about 18 to 24 per cent from suitable applications of alphanapthalene acetic acid. Just as important, the extra yield was not a result of larger beans, but rather of more beans of small size—the kind that bring the best price.

Using hormones in sprays did not work at all well in these tests. That seemed to be at least partly because a spray knocked off many blossoms and small beans.

Would combinations of hormone and insecticide work better than hormones alone? That seems logical, but no one has proved it as yet. Research workers mean to find out.

Would hormones — with or without insecticides—help other crops whose blossoms are known to be damaged by the Lygus bug, including Lima beans and alfalfa? That should be known, too, this coming year.

It is better to light a candle than to curse the darkness.

Old Chinese Proverb

Operation of the Barn Hay-Drier

Condensed from The Southern Planter

J. E. Collins

GREEN, leafy first quality hay is the end result obtained when using barn hay-driers, if they are properly installed and operated. Hay-drier equipment, like all other farm machinery, will not function properly if it is not ready to be operated or if it is not operated according to the best recommendations.

The hay-drier equipment should be checked and put in first-class operating condition long before it is time to cut hay. The main parts of the system to check are fan room, fan, motor, belts, duct system, barn roof, and mow floor.

The fan should be cleaned. Remove all trash, loose hay and cob webs. Be sure that the outside air intake opening is not obstructed and that the doors to the fan house are in good working condition. Give special attention to the door leading from the fan room into the hay mow. If this door does not close properly, recirculation of moist air will occur, thereby reducing the rate of drying. Fan rooms with large cracks in them should be covered with unslated tar or building paper to prevent recirculation of air. Only outside air should be drawn in by the fan and forced through the hay.

Remove all trash that has accumulated on the fan while idle. If the system is equipped with a propeller type fan and there is no guard for it, build a guard before the fan is operated. A fan guard can be built using ¾-inch mesh hardware cloth. Fan guards keep out rats and mice, and are also good safety measures. No propeller fan should be operated without a guard. Oil or grease the fan bearings according to the manufacturer's instructions.

Remove all trash from the motor and blow out the dust with a tire pump or portable air compressor. Check the oil wells on the motor and add oil if it is needed. S. A. E. No. 10 or 20 weight oil is recommended for large electric motor sleeve bearings. Start the motor to see that it operates properly.

New belts stretch with use and should be checked frequently and kept tight. Stop the motor and tighten the belts enough to prevent slipping. Be sure that the motor pulley is aligned with the

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fan pulley to prevent excessive wear on belts and pulleys. Heating of either motor or fan bearings is usually an indication that they need oil or that the belts are too tight.

Remove all loose hay and shatterings from the duct system. Start the fan and the air from it will aid in removing the shatterings. If lateral ducts are used, see that all of them are in position. If a slatted floor duct system is used, cleaning can be facilitated by removing the outside section of the slatted floor and then replacing it after all of the trash has been removed. Repair all broken sections of the slatted floor if they have been damaged.

A check should be made of the barn roof and all leaks stopped. A leaky roof will cause hay to spoil whether it is placed on a drier in the barn or cured in the field and then stored in the hay mow. A leaky roof will also cause the flooring and joints in the mow floor to deteriorate. This will require expensive repairs to the timbers of the barn if steps are not taken to repair leaky roofs immediately.

The mow floor should be checked and all cracks stopped and bad flooring replaced. If cracks have opened up in the mow floor, this will permit the air to escape down through the floor instead of being forced up through the hay. The mow floor serves as the bottom of the hay-drier system and must be kept practically air tight. Cracks in the mow floor can be filled with some type of sealing material or they can be covered over by using unslated roofing or building paper. Either method is satisfactory and it is usually good for several years.

After the hay-drier system is ready for operation, the operator must be able to answer the following questions: (1) At what stage of maturity should the hay crop be cut? (2) What time of day should the hay be cut? (3) How long should it be left in the field? (4) When should hay be placed on the drier? (5) When and how long should the fan be operated? (6) When is hay cured?

To make good hay, it is very important that the hay crop be cut at the proper stage of maturity. A hay-drier will help farmers to cure good hay, but it will not restore the leaves and green color if it was let stand in the field too long before cutting. Alfalfa should be cut between the one-tenth and one-quarter full-bloom stage. There is a definite time to cut all hay crops for best quality hay. Check with your local county farm demonstration agent for best stages of maturity to cut hay crops.

Two procedures have been used successfully by operators in

the time of day for cutting the hay crop. The best procedure for the farm should be adopted. The time of day that dew dries off the hay is a deciding factor. The first procedure is to begin cutting in the morning as soon as most of the dew is off, making sure that no more hay is cut than can be placed in the barn that afternoon. The second procedure is to cut late enough in the afternoon so that no wilting occurs that day and to leave the hay in the swath over night, cutting no more than can be placed in the barn the following afternoon. This procedure is used almost entirely on farms where the dew is not dried off of the hay until 10 or 11 A. M. Whichever procedure is used, care should be taken not to cut more than can be put in the barn at the proper time.

The hay-drier takes the weather hazard out of hay making. The hay is allowed to wilt in the field up to the point where the maximum amount of moisture is removed, but not dry enough for leaves to shatter in handling. The moisture content of hay at this stage of drying is approximately 40 to 50 per cent. Do not expose wilted hay to rain or dew. On good drying days, two hours in the swath and two hours in the windrow is long enough to leave the hay in the field if it is to be placed on the drier without chopping it. Hay to be chopped and then placed on the drier should be field dried to approximately 30 to 35 per cent moisture content.

Long hay must be distributed evenly over the duct system as it is unloaded into the mow. A hay hoist, operated by the same electric motor that drives the fan, speeds up the unloading process. These hoists can be operated satisfactorily by 3, 5, or 7½ hp. motors. Best drying results are obtained where not less than 4 feet nor more than 8 feet of hay is placed on the drier for the first loading. This first loading must be dried before additional hay is placed on the system. Additional loadings not exceeding 6 feet each may be placed on top of the first loading and cured. Not more than 15 feet in all should be placed on the system. If additional hay is to be dried, there are two alternatives. The first is to bale the hay off of the drier and store it in the barn. Second, additional hay-drier systems can be installed to take care of the entire hay crop.

If chopped hay is to be placed on the duct system, at least a foot of long hay should first be placed on the system to prevent the chopped hay from sealing off the air outlets under the hay. The chopped hay can then be blown into the mow and distributed evenly over the duct system to a depth of 4 to 6 feet for the first

curing. Care should be taken not to walk on this hay as it will pack and not cure properly. Additional cuttings of chopped hay can be added, not to exceed 4 feet each. Not more than 10 or 11 feet of chopped hay in all should be placed over the system.

The fan should be started as soon as some hay has been placed on the system, at least within 2 hours after the first hay has been unloaded. It should be operated at all times when the outside air is such that it will remove moisure from the hay. Usually, the fan can be operated continuously for the first 3 or 4 days to an advantage. When hay is first placed in the mow, it will give up some of its moisture very rapidly. After the first 3 or 4 days, the motor can be turned on the time clock control which should be set as follows: On, 8:00 A.M.; off, 9:00 P.M.; On, 12 M., off, 1 A.M.; on, 4:00 A.M.; off, 5:00 A.M. On rainy days operate the fan one hour at 3-hour intervals which is just enough to keep the hay cool. Keep all mow doors and roof ventilation open during the curing period to remove moisture laden air from over the hay.

The top foot of hay will be the last to dry. When this appears dry, stop the fan and leave off overnight. The next morning, start the fan and immediately walk over the hay to see if any warm air is coming out of it. If you find some warm spots in the hay, operate the fan two more days and repeat this check. Remember, it is always best to operate the fan a little longer than necessary, than not to operate it enough to finish curing the hay.

If it is desired to remove the hay from the drier to store in another part of the barn or to bale it, the hay can be conditioned by operating the fan a night or two before it is moved. This will help prevent shattering of the leaves and excessive dryness in the hay.

The Romance of the Gut

Condensed from Holstein-Friesian World

C. F. Huffman

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THE fabrication of feeds should take into consideration the nature of the digestive tract of the class of animals under consideration. The efficiency of feed conversion to human food in the form of eggs, meat and milk depends in no small part on the working over which it receives in the digestive tract.

Let us ascertain where the fermentation vats are located in a few of our farm animals. Probably the simplest gut is possessed by the pig although it frequently is difficult to keep filled. The pig has a digestive tract similar to our own except that in man the caecum which is called appendix usually does us more harm than good. The feed the pig eats goes directly to the stomach, then to the small intestine where it is digested by the enzymes elaborated by the animal and then the digested portion is absorbed. The remaining part of the food passes to the caecum which is about a foot in length and holds about 0.3 gallons. From the caecum, the material passes into the large intestine which is about 16 feet long and holds 2.3 gallons. The caecum and the large intestine make up the pig's fermentation vat.

The gut of the chicken although abbreviated, is nevertheless more complicated than that of the pig. The feed goes to the crop and then to the true stomach (proventriculus); then to the small intestine where the same types of digestive changes take place as in other animals. The chicken is unique when it comes to the caecum. Instead of the traditional one, two caeca are found which are about 7.6 inches in length and furnish a large fermentation vat in proportion to the size of the animal. The large intestine is very short.

The digestive tracts of ruminating animals such as sheep and cattle are unique. They start out at birth with a digestive tract similar to that of a pig; that is, only one functional stomach. The milk which the calf sucks from its mother follows a path that leads to the true stomach. The pail fed calf frequently takes large swallows which exert enough pressure to force the milk through the

Reprinted by permission from the Holstein World, Laconia, N. Y., April 5, 1947

lips of a groove (esophagael) into the undeveloped rumen. It is believed that the milk in the calf's rumen undergoes putrefaction which sometimes results in calf scours.

The first and second stomachs of the cow are really not separate compartments at all but make up a fermentation vat which holds about 300 pounds in case of a 1200-pound cow. Everything she eats or drinks passes to this vat where it is thoroughly mixed by the violent churning action of the powerful rumen walls. Heavy grain mixtures pass to the rumen as egg-shaped boli and are quickly mixed with the roughage. Consequently the old idea that bulk is necessary in the grain mixture is nothing more than a superstition. In our work with the heavy feeding of linseed meal which is one of the gummiest feeds known, old bossy was able to consume 18 pounds a day regularly without "gumming up the works." The ruminant has an auxiliary fermentation vat in the caecum and large intestine.

From the rumen and reticulum the feed passes through the omasum or third stomach into the true stomach. From this point on, the construction of the digestive tract is similar to that of the pig. It is apparent that the ruminant is equipped with two fermentation vats.

The location of the spacious rumen at the head of the digestive tract gives cattle and sheep a great advantage over such creatures as the pig, chicken, horse, and other simple stomach animals when it comes to handling hay and silage crops. The location of the paunch first gives the microorganisms which do the fermenting priority on the use of the nice juicy morsels in the ration, such as sugars, starches, and water soluble proteins.

As a matter of fact, the location of the rumen has enabled the cow to contribute to human welfare by turning great gobs of hay and grass into ice cream, milk, butter, and cheese, not to mention juicy steaks. Cattle and sheep also contribute to human welfare by consuming in large amounts the sod crops which do such a good job in tying down our precious heritage, the soil fertility which would otherwise sneak out to the sea. The great fermentation vat possessed by the ruminant contributes more to us than the prevention of soil erosion. These animals are soil builders. As it is well recognized by our agronomists that the proper use of sod crops in rotations actually increases the yield of grain crops such as corn and wheat.

The importance of the fermentation vat can best be appreciated when one realizes that at least half of the dry matter of pasture grass or hay can not be digested

without the help of bacteria. There are countless numbers of bugs or bacteria and many large organisms known as protozoa which make their home in the fermentation vat. Some of the bacteria can not be grown in the laboratory outside the rumen. A few of these can be identified because they are stained blue with iodine. Many of the microorganisms present in the rumen come from the feed and are believed to be just passing through for the ride. We call these the "thumbers."

When the old cow eats her feed of roughage and grain, the bacteria hop on it, and in a short time have digested. As a matter of fact, the great speed at which fermentation takes place should be the envy of every brewmaster. The sugars, starches, and other simple compounds are used first and then the bugs jump on the fibrous feeds and digest them. Most of the digestion is complete at the end of six hours and all is finished at the end of 12 hours after feeding. Too much sugar feed such as molasses decreases digestibility of the roughage part of the ration. The theory explaining this decreased digestibility is that bugs eat so much sugar that they do not have an appetite for roughage.

Many organic acids are produced during fermentation. About three-fourths of the acids produced are made up of acetic acid which is the acid in vinegar. In addition there is some lactic acid the same as in sour mlk, also pyruvic and formic acids. In order to prevent the development of too much acidity in the paunch the cow secretes about 120 pounds of saliva a day which furnishes the equivalent of three-fourths of a pound of sodium bicarbonate. The saliva has other uses besides neutralizing acids. The writers of poetry and prose all down the ages have raved about the sweet breath of kine. In a recent experiment we showed why a cow's breath is so sweet. When we add onions or garlic to a cow's saliva, there is a compound present in the saliva which covered up these odors. The cow has another mechanism for preventing too much acid in the rumen—absorption through the rumen wall. In the past the opinion prevailed that such absorption was unlikely. Recent work, however, indicates that glucose, several drugs and short-chained fatty acids are absorbed through the rumen wall.

The principal gases produced during fermentation in the tract are carbon dioxide and methane, although traces of carbon monoxide, carbon di-sulphide, hydrogen and nitrogen are sometimes observed. Usually at the peak of rumen fermentation about

two-thirds of the gas is carbon dioxide and one-third methane. In the ruminant some of the gas passes through the rumen into the blood stream and is eliminated through the lungs. A large part, however, is eliminated by way of the mouth. Hence, the cow is known as the world's best "burper."

Things are not always "hunky dory" in the rumen. Occasionally for some unknown reason the gas eliminating mechanism fails and the cow "blows up like a balloon." There are many theories which attempt to explain the cause of bloat. In the old veterinary books is found advice to cattlemen which, if followed, was supposed to prevent bloat. Never pasture cattle against the wind. always pasture cows up hill and never facing down hill.

A theory long accepted but now in ill favor explained bloat on the basis of increased rumen fermentation when cattle were pastured on succulent legumes. Recent data indicate that the eating of pasture grass does not result in increased gas formation. Then there is the theory that bloat is due to eating too much feed too fast. Still another theory is "the lack of coarse roughage" theory, which is based on the need for coarse feed to tickle the wall of the rumen which is supposed to stimulate the belching mechanism. The "toxic gas" theory is based on the production of sufficient carbon monoxide, or hydrogen sulfide, to paralyze the rumen wall, thereby preventing belching.

Although synthesis of dietary factors occurs in the caecum and large intestine of simple stomach animals it really reaches its peak in the rumen of the ruminant. The good bacteria digest the feed by secreting enzymes and then absorb these products immediately before some worthless bug eats it. As a matter of fact, this explains in part the efficient conversion of the roughage and other feeds consumed by fermentation into feed constituents which can be used by the cow. The cost of fermentation is about 10 per cent of the dry matter digested which is certainly a fair price to pay for so great a job.

There are several kinds of bacteria that are believed to play a vital role in rumen digestion and synthesis. Probably the most numerous and present in the largest volume in the paunch are cocci which appear in pairs or in threesomes or foursomes. Then there are many chains of very small cocci, some spirals and occasionally a large rod which we have dubbed the "cigar." The origin of these bacteria which cannot be grown outside the tract is not known, but may come from the manure.

These bugs are capable of

making a lot of good compounds needed by the animal. They can take simple nitrogenous compounds such as urea and convert it to protein of a biological value of about 65 per cent. This protein is inferior to our high class protein sources, such as milk, egg and meat proteins. Nevertheless the ability of the bacteria to step up the quality of the protein explains why the amino acid balance is usually not considered in balancing the ration of ruminants. There is some evidence, however, which indicates that rumen bacteria can not synthesize the amino acids tryptophane and methionine.

The ruminant carries her vitamin factory with her at all times and does not need to visit the corner drug store to get her supply of thiamine, riboflavin, niacin, pantothenic acid, paramino benzoic acid, biotin and vitamin K. These vitamins and probably many other unknown dietary factors are synthesized by the rumen bacteria. During the war period, we put rumen fistula (windows in the rumen) in three small Jersey cows. The weight of paunch in these animals resulted in pulling the holes larger, so that it was impossible to keep them closed with plugs. As a result air circulated in the rumen. This affected fermentation markedly since under normal circumstances feed is acted upon in the absence of air. The cows lost their appetites and red cells became abnormal in shape and the cows eventually died. This indicated to us the importance of proper rumen fermentation.

Some years ago when we started our studies on chemical changes in the rumen we removed the rumen contents from a rumen fistual cow, which is a very laborious task. The rumen contents were mixed and samples taken for chemical analyses. It was 6:00 P.M. Should we take the time to return the rumen contents and miss our supper, or should we fill the manger, let the cow have the pleasure of filling her paunch? We chose the latter course. But it did not work out according to plan. The cow lost her appetite. After three weeks of starvation, we went to the slaughter house, borrowed the rumen from a freshly killed steer, and poured it into our sick rumen fistula cow. Her appetite showed marked improvement the next day. This was the first rumen transfusion in history.

How does the cow utilize the products synthesized by the bacteria? There are two theories answering this questioin. One theory postulates that the big bugs known as protozoa gobble up the bacteria and process them, so that they can be digested by the animal's own enzymes. The other theory assumes that the

food laden bacteria are carried down the digestive tract where they commit hari kari by jumping into the true stomach. After that they are digested like any other feed. Recent research at the University of Illinois indicates that the latter theory is more likely.

The bacteria which play a vital role in rumen fermentation also are present in the caeca and large intestine of simple stomached animals and are even present in the large intestine of man. Of course, they are greatly handicapped by position, but when pigs or chickens are pastured on tender grass, the fermentation vat does a grand job. These short gutted animals appear to digest tender grasses just as efficiently as do cattle and sheep. Of course, the bacteria are responsible for the digestion of about one-half of the dry matter of the grasses. When it comes to mature hay and pasture crops, ruminants do a much better job than the pig.

The next time you eat lettuce, celery or force yourself to eat some of that "glorified pasture grass" known as spinach, just give the bugs in your colon a little credit for a grand job.

Research workers in South Africa working with sheep have shown that rations made up of poor hays or straw result in very little gas production compared with a ration of good alfalfa hay. Also, the addition of glucose to poor hay failed to stimulate fermentation. Results at the Ohio Agricultural Experiment Station showed that more riboflavin was synthesized in the rumen the finer the corn was ground. Wisconsin workers found that the addition of urea to a ration of timothy hay was of no value to the ruminant until starch was also used as a supplement. Recent results at the Cornell Agricultural Experiment Station indicate that the addition of methionine to the ration of lambs increased the value of urea used as a supplement to a low protein basal ration.

There is some evidence that the vital role of cobalt in animal nutrition may depend on the need of certain vital bacteria in the rumen for this element. It has been shown that only ruminants suffer from a deficiency of cobalt.

In our dairy cattle nutrition investigation, we are studying how to balance the diet of a few species of bacteria which are numerous in the rumen and can not be grown outside the animal's fermentation vat. The possibility of increasing the efficiency of conversion of feed to food by stepping up the tempo of fermentation in digestive tracts of farm animals is an intriguing one.

The feces or manure of cattle has long been used as an indication of the well being of the

animal. Some feeds result in feces of very hard consistency, while the feeding of others results in feces with soft consistency. The soft feces may be due to irritation of the tract by bacterial poisons or it may be due to physiological effect on the tract. Cattle feces probably should be on the soft side due to the effect of the feeds. Pasture grass and most grains have water-loving compounds which take up water and soothe the tract.

Many years ago cottonseed meal was believed to be constipating but experiments showed that the heavy feeding of this feed resulted in a soft feces. Many feeders believe that the feeding of extra salt results in softer feces. This was true for the day following the first heavy shot of salt, but after that, the continued feeding of extra salt did not prevent the feces from becoming more costive.

The value of cow manure as a supplement to swine and poultry rations has recently been demonstrated. Many of the B vitamins are synthesized in the large intestine but due to inefficient absorption pass out in the feces. Feeders have long believed that pigs following corn fed steers do better than when fed corn which has has not taken the dramatic trip through the gut.

"The highest test of the civilization of a race is its willingness to extend a helping hand to the less fortunate."

Inscription Beneath Bust of Booker T. Washington in Hall of Fame

RUST: Shifty, Costly Wheat Enemy

Condensed from The Western Farm Life

R. E. Atkinson and D. W. Robertson

Colorado Agricultural Experiment Station

WHEN a green field of grain turns a rusty red and becomes a seared brown expanse of rattling dry leaves weeks before the time for the harvest, a farmer knows the sad story. He rubs a head of wheat in the palms of his hand and knows there is little or nothing to harvest. As he blows on the threshed head and the light shriveled kernels blow away with the chaff he will say, "Five-10 bushels; 30-35 pounds."

That is his return from land on which taxes continue as usual, on which payments must be made or rent paid, unless he owns it outright — land which he has plowed, disked, harrowed and planted, using expensive seed and costly power equipment. And after all this, he has to ask himself, "Is the yield worth the cost of threshing?"

Almost every plant has a rust disease, and cultivated crops are not excepted. Wheat has two of these dread enemies, leaf rust and stem rust. Leaf rust takes a yearly toll, but stem rust occurs in epidemics. Sometimes these disasters are local; often they are national, as in 1916 and 1935 when the nation's breadbasket became rusty fields of red destruction.

Despite years of research by experiment stations and by the United States department of agriculture, rust sometimes makes a break through. In 1944 rust developed extensively in Kansas and was blown into eastern Colorado where it wrought destruction estimated at $4,000,000. The red plague continues to be a threat every year, and state and federal workers are still allied in a giant effort to defeat this insidious enemy.

Epidemics often cause a shift to new varieties. This is not a solution, for every major shift in wheat varieties has produced new disease problems. It is an old, old story. In 1916 the rust epidemic caused many farmers to abandon bread wheats and grow durums, which are resistant. But other diseases pushed durum production farther and farther north and west until now it is produced chiefly in the northern half of North Dakota. Durum yielded to Ceres and Marquis.

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These varieties were eliminated in the stem epidemic of 1935.

There was a hopeful note in that epidemic. In the spring wheat area an occasional patch stood green and gold in the checkerboard of cropland among the brown, dead wheat fields. There fields were planted with Thatcher, a wheat developed by the Minnesota experiment station and the federal government and released in limited amounts in 1934. It was developed as a spring wheat resistant to rust, and its quality was proved in the epidemics which followed.

Thus the way was pointed for Colorado research men in combating rust in this state. But the introduction of Thatcher and its almost exclusive planting in the spring wheat area was not a complete victory. Thatcher is susceptible to leaf rust which every year reduces yield. Of course, the crop isn't destroyed, but the annual loss keeps accumulating.

Plant pathologists, know, too, that diseases change in importance with change in varieties and they also know that even the germs causing disease are shifting in nature's constant turnover.

Just as there are many varieties of wheat, so there are many races or strains of stem rust. After 30 years of study more than 200 different races have been found. To illustrate how they differ, compare their action on one durum variety, Mindum, and two spring wheats, Marquis and Reliance. Marquis is susceptible to strains 17 and 56 but resistant to strains 19 and 38; Reliance is immune to 17 and 19 but susceptible to 38 and 56; Mindum is susceptible to all four.

Obviously a wheat to be successful must be resistant to all these common races of stem rust. It must also be resistant to leaf rust, smut and other diseases attacking leaves, stems and roots.

It would be helpful if these enemies having identified themselves, would stay put until plant scientists could aim their blows at them. But they shift and weave and sidestep. Race 56, which knocked out Ceres and Marquis in 1935, first appeared in 1928, increased slowly for several years and then became rampant. It was identified 14 times in Colorado in 1940 and 1942, 28 in 1941 and 40 in 1943 and 1944. In the same 5 years, race 17 was noted every year, 38 and 36 in 4 different years, 147 twice, and 142, 49, 24, 19, 15 and 9 once, each.

Thatcher and even Newthatch, an improved strain of Thatcher, are not resistant to all races of stem rust. Race 15B attacks both varieties severely, but this strain has been found in only small amounts so far. Will it increase and wipe out these new

varieties? We have to wait and see and hope. And even that isn't the whole story. New races of stem rust are developed on the barberry bush, the alternate host of stem rust. The prevention of new races from forming is an important reason for the eradication of barberry.

Barberry eradication was started to prevent local epidemics of stem rust. Thirty years ago local epidemics of stem rust were common. Oats, wheat, rye and barley all rusted heavily. Rust centered around barberry bushes where it got an early start each spring. Thus invariably it caused extensive damage and often complete destruction before harvest.

In 1918 in 13 midwestern states barberry eradication was initiated. Later five other states were added to the original number. As a result of this action and through continued vigilance guarding against the growth of seedlings and sprouts from the original bushes, local epidemics of wheat rust and the stem rust of oats, barley and rye have been virtually eliminated. Perhaps of greater importance, since barberry eradication was initiated, the races of wheat rust have been stabilized to some extent.

In Colorado all new strains of wheat are first tested for their reaction to the prevalent races of stem rust and leaf rust. These tests are conducted in a greenhouse where summer "rust weather" conditions can be simulated and the wheat subjected to "spore showers." The resulting infection is classified as to the size of the pustule produced.

Damage caused by rust is largely due to excessive loss of water through the ruptured skin or epidermis of the wheat plant. Thus the size of the blister affects the amount of water loss. Large pustules on succeptible varieties mean that the wheat in an epidemic would dry up and die before the kernels are filled and as a result produce shriveled grain. Resistant varieties have small pustules or merely a discolored area where infection takes place, and the amount of water lost is not excessive. In an epidemic the wheat would survive and produce plump kernels.

In 1945 selections were made in the field. From these, 102 rows were planted in the fall of 1945 and subjected to a rust epidemic in the field in 1946. Humidity was kept high by the use of an overhead sprinkling system. From the thousands of seeds planted, only 48 resistant plants were saved and planted in the fall of 1946. These are also being grown in the greenhouse and tested for resistance to leaf and stem rust.

About 4,500 seeds from crosses of rust-resistant wheats with poor milling quality by susceptible

high quality varieties have been planted and in 1946, 23 additional crosses were made.

Several years will be needed to select out and test those hybrids before they can be released. The progress of the work looks promising for the continuing development of rust resistant wheat varieties.

Danger to Soil Bacteria?

Recent tests have shown that DDT and 2,4-D may interfere with nodulation of legume crops. In Illinois tests, M. D. Appleman and O. H. Sears found nitrogen-producing nodules did not form on roots of some legumes in soil layers containing strong concentrations of DDT. However, there was nodulation below the treated zone.

Apparently DDT does not leach away readily. Large amounts might accumulate in orchard soils, on potato ground and in alfalfa and clover fields heavily treated year after year for control of insects. Such a build up might reduce materially the soil nitrogen that could be supplied to trees and field crops by growing legumes.

There are other nitrogen-forming bacteria in the soil besides those that require legumes as a host. What will large amounts of DDT do to them? What about angleworms, whose tunnels help to carry water and oxygen to lower depths of the soil?

Two Colorado scientists, Merle G. Payne and Jess L. Fults, noted that bean plants growing in soil previously treated with low concentrations of 2,4-D failed to develop nodules. Trials showed that when beans were planted in soil that had received as little as an ounce of 2,4-D an acre they failed to develop root nodules. When amounts required for weed control were mixed in the soil the bean plants were dwarfed and malformed. Payne and Fults also tested DDT, and got results similar to those reported by Illinois workers. There were no unfavorable results from Colorado 9, an insecticide similar to DDT.

DDT seems more of a threat to legume nitrogen production than 2,4-D. The effects of the latter seem to disappear from the soil after a couple of months.

Capper's Farmer

The Role of Major Elements in Plant Nutrition

Condensed from Better Crops with Plant Food

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ANY discussion of the internal factors associated with the development of plants will nearly always include the essential elements and the part they play, just as it would probably include a discussion of some phase of their water relations, their translocation problems, the mechanism or channels involved, the problem of respiration, the phenomena of growth and in recent times that of the growth promoters.

The discussion of the elements necessary for plant growth is probably not so simple and straightforward as it once was and, I suspect, the role of each cannot be stated so conclusively. It has been almost a hundred years (1844, according to Brenchley) since the first paper was published describing deficiency symptoms and calling attention to the essential nature of certain elements for plant growth. This first element was, as might be suspected, iron, since its lack is so striking. For a number of years (by 1860) the technique of growing plants in solution culture from which one element was omitted had developed so far that it was considered that 10 elements were necessary for plant growth. These 10 were carbon, hydrogen, oxygen, nitrogen, magnesium, iron, sulfur, calcium, phosphorus and potassium. These investigations were repeated and verified so often that these 10 came to be recognized as the essential elements, even though it was known that a number of other elements were to be found in plants by analysis.

In 1915 Mazé published a paper showing that other elements besides these 10 might be necessary, but so well-grounded was the belief in the 10 that it was another 10 years before there was acceptance of the fact that the 10 might not be all that were needed for normal growth. This

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situation raises the question of what might be a criterion by which the indispensability of an element would be judged. A basic concept would probably be as follows: "Necessity of an element for normal plant metabolism is demonstrated only if lack of it can be shown to result in injury, abnormal development, or death." The hub of this concept lies in the "lack" of an element. Under our present concept of technique this means that the plant must be grown in some sort of culture solution from which the element in question has been eliminated or reduced by the most refined methods. Modern investigations have recognized the difficulties associated with eliminating an element from culture solutions and have suggested certain previously unrecognized sources of error in the older experiments: (1) Many of the "pure" chemicals used contained, at least, traces of other elements which may have been sufficient to supply the plant with its needs; (2) the elements stored in the seeds were not usually considered in these experiments and sufficient amounts of an element might be contained here for normal growth; and (3) certain elements may dissolve from the walls of the containers in which the plants are growing or in which the reagents are stored.

A failure to place emphasis upon the "lack" of an element is shown by some investigators who have noted increased growth when an element has been added to a complete culture solution. By such a procedure there have been many elements reported as increasing plant growth and the assumption made that they were therefore necessary. Such a condition may, however, fall short of proof that such an element is necessary for growth; it may only alter some characteristic of the solution making it more favorable for growth of the plant. Furthermore, before the necessity of an element for green plants has been proved it should be shown necessary for a number of species.

Using the critical concept indicated above there are probably 14 or 15 so-called essential elements for plant growth, even though as many as about 40 have been found in plants on analysis and one writer has suggested that the whole periodic table may be found when proper techniques have been developed.

To recapitulate: Our original concept of the elements necessary for plant growth obtained by the technique of solution culture was so well founded that it wasn't seriously challenged for more than 50 years. The change in concept has been in the nature of additions rather than revision, occasioned by improved tech-

nique and an understanding of the very small amounts necessary. The current concept would suggest that the list might keep growing as additional and more critical investigations were made.

A number of ways of classification of these necessary elements is possible, none of which is wholly satisfactory. The following classifications are representative of the attempts that have been made.

1. According to their source; C, H, O coming from the air and water, the remainder of the elements from the soil.

2. According to their ashing properties, C, H, O, N being lost on burning, the others remaining in the ash.

3. According to their supposed function:

a. energy exchange group—H, O
b. energy storers—C, N, S, P
c. translocation regulation — K, Ca, Mg
d. oxidation reduction regulators —Mn, Fe, Zn, Cu

4. According to the amount necessary for growth—the major and minor (micro, trace), elements.

It can be seen that none of these classifications is entirely satisfactory. The first two are strictly artificial and give no indication of the role of the elements. The third is a more nearly rational one but the difficulty lies in exactly cataloging an element so that all its functions lie in that group. It omits entirely the function that some element may have in some building structure or in a compound. The last classification is perhaps a more desirable one for our present thinking, especially if the emphasis is placed upon the historical or developmental aspect. It scarcely seems wise to lay too much emphasis upon the relative amounts needed by the terms "major" and "minor." Certainly "major" and "minor" cannot be taken to indicate degrees of indispensability since I assume there is no such thing. They are indispensable or they are not!

The elements needed by plants may subserve a number of functions. Among them are the following:

1. Some of them are component parts of the cell structure such as the cell wall or of the protoplasm. The amount of the different elements used for these purposes may be relatively large, and any deficiency of them is soon noticed in the general growth of the plant.

2. As sources of energy for the varied functions.

3. As influencing elements.

a. on osmotic pressure of cells
b. on acidity and buffer action
c. on hydration of the cell colloids
d. on permeability of cell membranes

e. as antidotal or antagonistic agents

f. as carriers of other ions

g. as catalyzers of reactions.

It is not always easy to assign a specific role to an element and feel certain that its sole function lies here. When an element forms an integral part of some building material or compound whose function is known, and whose lack in a culture solution does not result in irregularities other than those expected of this building material or compound, then the role is rather easy to assign. But frequently the lack of an element will result in abnormalities that cannot be simply explained. All of the 10 major elements have been shown to be necessary to the growth of trees under controlled conditions. The symptoms of a lack of an element are in general the same for trees as for other experimental plants. Primarily, I assume, because of the ease of manipulation nearly all the work in exploring the role of the elements has been done on plants other than trees. What will be said regarding the role of each will therefore be the result of investigations on other plants, but it may be fair assumption that they would play the same role in trees.

Carbon, Hydrogen, Oxygen (C), (H), (O)—These three are constituents of a very large proportion of all the materials in a plant. They serve:

1. As part of the cell structure in the cell wall and protoplasm.

2. As energy materials — carbohydrates, fats, oils.

In trees the primary energy material is usually in the form of carbohydrates. These may be broken down into those used (a) for current use and (b) for storage.

For our discussion three carbohydrates may be considered as furnishing the bulk of those for current use. These are the sugars —glucose, levulose, and sucrose. All three are water-soluble and serve as the sugars that are translocated from one part of the plant to another. The first two of these, glucose and levulose, have the power of reducing certain compounds and are therefore spoken of as reducing sugars. Sucrose does not have this power of reduction and is therefore spoken of as a non-reducing sugar. In the literature dealing with the metabolism of trees, reducing sugars refers primarily to dextrose and levulose, non-reducing to sucrose, and total sugars means the sum of all three. In trees, the chief storage carbohydrate is starch. This material breaks down into glucose when hydrolyzed by dilute acids or by enzymes. It can, therefore, be considered as a condensation product of a number of mole-

cules of glucose. An additional carbohydrate, hemicellulose, occurs in trees and vines and is said to be a reserve storage product. It yields reducing substances when hydrolyzed by dilute acids; in this case, however, a mixture of sugars results, glucose mixed with two five-carbon sugars, xylose and arabinose. There is considerable controversy regarding whether or not hemicellulose is a storage material. We can, perhaps, best leave it by saying that it does occur in varying quantities in trees and that investigators are not agreed about its function.

Nitrogen (N) — As a component of the proteins and therefore of the protoplasm, this element has a role in which a lack is very readily visible by reduced growth and a lack of green color. Nitrogen is also a part of the chlorophyll molecule.

Iron (Fe)—This element is necessary for the synthesis of chlorophyll, although it doesn't enter into the chlorophyll molecule. The state of the iron in the plant is important, an abundance may be present yet not be in an available form. Such a condition exists in our lime-induced chlorosis. Iron is also supposed to act as a catalyst or oxygen-carrier in oxidation-reduction processes occuring in living cells. The proportionate amount of this element in plant tissues is low, much of it in organic compounds. It is one of the most immobile of the elements, no appreciable redistribution ever occurring from one tissue to another. Hendrickson has observed that chlorotic pear leaves sprayed with iron sulfate became green under a drop of spray but not in adjacent areas not wet by the spray.

Magnesium (Mg) — Magnesium forms a part of the chlorophyll molecule and as such is necessary in green plants. When lacking, characteristic chlorosis and perhaps bronzing occurs. Unlike Fe, Mg is readily redistributed from older to younger parts of the plant. Mg is also believed by some workers to be associated with the synthesis of oil and nucleo-proteins in plant cells. Many cases of Mg deficiency have been reported under field conditions.

Calcium (Ca)—A large proportion of the Ca in most plants is located in the leaves. Very little redistribution ever takes place. The Ca content of leaves constantly increases throughout the season. The element apparently plays a multiple role in plant metabolism. (a) It is a constituent of the cell wall as Ca-pectate in the middle lamella. (b) It may influence the permeability of the cytoplasmic membrane. It has been found that plants growing in Co-deficient solutions may lose ions to

the solution, whereas in solutions above a certain concentration of Ca accumulation occurred. (c) It may serve as a neutralizer for certain organic acids, especially oxalic or as an antidoting agent for other ions. (d) It may serve as an aid in translocation of carbohydrates. In absence of Ca starch has been observed to accumulate presumably due to lowered diastatic activity. In culture solutions lacking Ca there was a severe stunting of growth, and almost total failure of roots.

Sulphur (S)—S is a constituent of the amino-acid cystine, which in turn is one of the compounds from which many plant proteins are made. It is also a constituent of glutathione, a compound supposed by many investigators to play a part in the respiration process. Although the exact role is not known, at least one case of deficiency has been reported, that of tea yellows.

Phosphorus (P)—This element apparently plays both a direct and an indirect role in the plant's metabolism. It forms a part of various organic compounds such as the nucleic acids and the phospholipids (lecithin). Deficiency of P interferes with the synthesis of these compounds and hence may interrupt normal cell division. In addition, P acts as the co-enzyme of zymase, seems to exert an accelerating effect in other oxidizing and reducing enzymes and seems to be necessary for hydrolytic transformations of carbohydrates. This element occurs in the greatest abundance in young meristematic cells and in seeds. It is apparently readily redistributed in plants from one part to another.

Potassium (K)—Unlike the other major ash constituents K is not definitely known to be built into organic compounds of fundamental physiological significance. A large proportion of the K in plants is in a soluble form and seems to be readily translocated from one part to another. Relatively large quantities, compared to some of the other ash elements, seem necessary to avoid serious injury. Since it is not used in the construction of some vital cell constituent, it must play a regulatory or catalytic role. The following processes seem to need K for their normal maintenance: (1) The synthesis of simple sugars and starch; (2) translocation of carbohydrates; (3) reduction of nitrates; (4) synthesis of proteins, particularly in meristems; and (5) normal cell division. These conclusions are based upon such experiments as those of Russel for mangolds where 7,255 pounds of leaves produced 14,684 pounds of root in a K-deficient soil, whereas 8,508 pounds of leaf produced 40,128 pounds of root in the same soil that had been supplied with K.

Or the experiments of Nightingale in which sugars accumulated in K-deficient plants because N-assimilation had been interfered with. In Spirogyra, normal nuclear division failed to occur in the absence of a potassium supply.

Lime Treatment of Floor Litter for Chickens

Condensed from Farm and Home Research

D. C. Kennard and V. D. Chamberlin

Floor litter, that sort of "necessary evil" for chickens, has been going through an interesting and rapid evolution during recent years. Previously, the common practice was to remove and renew the floor litter in brooder and laying houses every week or so. Now, by means of built-up litter practices and the use of hydrated lime, the floor litter may be used in the brooder house for 8 to 16 weeks or longer without removal. In the laying house it need be removed only once a year.

Frequent removal and renewal of the floor litter from brooder houses was to avoid dampness and thus aid in the prevention of coccidiosis. The primary purpose for frequent removal and renewal of the floor litter from laying houses was to prevent dampness. Later, this object was accomplished better by insulation of laying houses and by means of built-up litter which protected against the cold and the dampness that followed from condensation. When built-up litter became an accepted practice, treatment of the floor litter with hydrated lime evolved. The advantages of this treatment are surprising in many respects.

To begin with, poultrymen need not fear the proper use of

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hydrated lime in brooder and laying houses. Until recently, it was supposed that hydrated lime was objectionable because of its liberation of ammonia from the droppings. Moreover, the released ammonia was supposed to have an irritating effect upon the eyes and respiratory organs of the chicken. Contrary to these suppositions, the New Jersey Agricultural Experiment Station recently reported that hydrated lime can be used safely as a deodorizer and preservative of nitrogen in droppings. Moreover, its use in the floor litter in brooder houses was reported as preventive of the spread of coccidiosis. The Western Washington Agricultural Experiment Station reported favorably on the use of lime in floor litter for layers.

Many treatments and procedures for the prevention and control of coccidiosis have been tried and found wanting. If the treatment of the floor litter with hydrated lime should aid in the prevention or control of coccidiosis, it would be a boon to poultry raisers everywhere.

During the past 2 years, the Ohio Station successfully used shavings with additions of hydrated lime in a brooder house for five different broods, each of 2,000 chicks. The use of hydrated lime was in no way objectionable and greatly improved the condition of the litter. By the use of hydrated lime and frequent stirring, the litter was kept in good condition without removal for periods of 12 to 16 weeks, even during the fall, winter, and early spring when dampness was the most troublesome. The air in the brooder house was noticeably more free from odors, even when the brooder house was quite closed because of cold weather. Best of all, there were no noticeable evidences of coccidiosis in any of the five broods with a total of 10,000 chicks. Seldom did a brood escape an attack of coccidiosis before the use of hydrated lime.

Hydrated lime can be used with any of the common litter materials such as straw, ground corn cobs, cut or shredded corn stover, wood shavings, peat mass, or cane litter. The principal requirement is that the litter be stirred at frequent intervals and additions of hydrated lime and fresh litter be made as indicated by the condition of the litter, all of which will depend upon the age, number of birds, and weather conditions.

The procedure followed by the Ohio Station at Wooster was to scatter the hydrated lime over the litter at the rate of 10 to 15 pounds per 100 square feet of floor space. This was done at intervals of 2 to 4 weeks or longer, depending upon the compaction and surface condition of the

litter. Sometimes a light covering of fresh litter was scattered over the lime and both stirred in with the old litter. Care should be taken to thoroughly mix the fresh lime in with the old litter; otherwise, the unmixed lime on the surface of the litter may have a mild caustic effect upon the chicks' feet. During the intervals between additions of lime and fresh litter, a redistribution of the floor litter to the other less used parts of the room should be made when the litter becomes packed or caked on certain floor areas, as around the watering and feeding equipment. Moreover, it is necessary to thoroughly stir and redistribute the litter over the pen every 2 or 3 days, depending upon the number and size of the birds and the weather conditions, or whenever the surface of the litter becomes packed or caked. After the first 8 weeks, daily stirring of the litter is often advisable. Lime is seldom used or needed until after the first 4 or 5 weeks.

Lime treatment of the floor litter in laying houses differs little from that of brooder houses except that the amount of hydrated lime used for a given treatment may sometimes be greater and the treatments less frequently needed. The Washington Experiment Station has recommended 1 pound of hydrated lime to each 3.3 square feet of floor space, or about 1 pound per layer for each treatment.

The practice of the Ohio Station has been to apply 12 to 15 pounds of hydrated lime to each 100 square feet of floor space and cover the newly added lime with a light covering (1 to 2 inches) of fresh litter. Both are then stirred into the old floor litter. This is repeated at intervals of 2 to 4 weeks or longer, depending upon the weather and litter conditions to be dealt with. As emphasized in connection with the brooder house, it is very necessary that the litter be thoroughly stirred once or twice a week between the lime treatments, or whenever the surface of the litter becomes packed or caked. When the litter around watering and feeding equipment becomes in bad condition, it should be shifted and replaced with dry litter from other parts of the pen.

The proper use of hydrated lime to recondition the floor litter in the laying house has agreeable surprises for many poultrymen, especially those who have reasonably well insulated laying houses. A typical example was recently experienced at the Ohio Station's poultry plant. In the laying house were 500 Rhode Island Red pullets in 70 per cent egg production. After 6 weeks, the floor litter had become very damp, packed, and caked, espe-

cially around the feeding and watering equipment. Before the use of hydrated lime, this would have meant removal and renewal of the floor litter. With the lime treatment, however, and a light addition of fresh litter, stirring and redistributing the litter as suggested above, the floor litter was brought back into good, loose dry condition within 1 to 2 days. That was on October 16 and the litter remained in good condition until November 16, when it was in need of another treatment.

Insulated brooder and laying houses and built-up litter practices have relieved poultrymen of much of the drudgery and expense of the past in connection with the frequent removal and renewal of the floor litter. Now comes the treatment of the floor litter with hydrated lime which promises a still better solution of the floor litter problem. Should the treatment of the floor litter in brooder houses by hydrated lime aid in the prevention or control of coccidiosis, that, of course, would be of still greater importance.

Star Farmer

Condensed from Eastern States Cooperator

A $30,000 yearly business on a worn-out farm is not a fantastic tale taken from a story book, but the actual accomplishment of the Carlin brothers, of Coatesville, Pennsylvania, and this feat has been accomplished by two former "town kids." Their father never was a farmer nor lived on a farm. He is a law clerk and treasurer of Chester county.

Several years ago, Walter D. Carlin, Sr., had the desire to buy a place in the country on which to raise his family. Little could he visualize the outcome when he bought a 121-acre farm not far from his old home in Coatesville. He planned to have tenant farm-

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ers operate it for him, but when the second one left he learned the farm was in such rundown condition that it did not attract another. There seemed to be but one alternative—dispose of the farm if he could find a buyer.

However, he had not figured on the reactions of his two sons, Walter, Jr., and William, who were at the time enrolled in vocational agriculture and very much interested in their home projects. They prevailed upon their dad to give them a chance to redeem the farm before it was sold. So, in 1940 the two boys became partners and took over on a rental basis. With lots of ambition, a few project chickens and two dairy heifers, they went into a huddle with their vocational teachers and laid out a long-time farming program adapted to the condition of the farm.

With a definite aim in mind, the boys really went to work. William told us the story of what happened:

"Previous to our taking over this 121-acre farm, it had been farmed out. Because of long mistreatment, severe sheet and gully erosion had taken place. Much topsoil from fields adjoining the buildings had been removed and used in mushroom growing. Buildings were in poor condition and the entire property was in anything but a satisfactory condition.

"After taking a general survey of the farm we decided to spend most of our efforts and what money we made from our vocational projects on soil improvement. Within two years, crop yields were considerably above those of previous seasons. As our farming program grew in both quantity and quality, we began to purchase and spread limestone to the crop and pasture land. Meadows were topdressed and crops were turned under for green manure. These practices were most helpful in restoring our acres to a productive state of fertility.

"Typical of the treatment of most of our soil was that given one three-acre field. In 1943 corn was planted in this field, but because only a small percentage of it came up—and that to be choked out by morning glories — no crop was harvested. It was plowed again in 1944 with the intention of planting soybeans. Time did not permit us to plant this crop so it laid open all summer. In August, 400 pounds of 3-12-6 fertilizer was drilled for a seeding of alfalfa. Being such a dry fall, the alfalfa was not seeded; rye was planted instead. In the spring of 1945 five loads of manure reinforced with 100 pounds of 20% Superphosphate per load, were applied. Two hun-

drer pounds of nitrogen fertilizer to the acre was drilled to aid in the decomposition of the rye when it was plowed under for green manure. Corn was then planted with 250 pounds of 3-12-6 fertilizer per acre in the corn row. This made a total amount of plant food for the corn crop as follows:

1. Three tons of ground limestone per acre. (1½ tons, 1943, 1½ tons, 1945).

2. Five loads of reinforced manure per acre.

3. 1350 pounds of fertilizer per acre.

4. Rye crop plowed under for green manure.

The result of this "experiment" was a yield of 100 bushels of shelled corn. This kind of crop from land that had been so useless before led us to believe that this kind of practice was not foolish.

"Guided by that year's fertilization results, fertilizer application on 52 acres of corn in 1946 averaged 1350 pounds to the acre. All of this acreage also benefited from a green manure crop. We believe in this soil improvement work so much that it is very seldom we plow a field where there isn't a sod or other green manure growth to be plowed under. Since 1940 we have purchased and spread 325 tons of ground limestone or hydrated lime.

"Aside from the fact that these practices are enabling our soil to produce more and better crops, we hope they set an example for others of the community in making them conscious of soil erosion."

So successful were the Carlin brothers that in 1944—with only four years back of them as farmers—they bought 90 of the 121 acres from their father and leased the remaining acreage on a yearly basis. In addition, these young partners rent 70 acres away from home and own a half interest in the 14-cow dairy herd on it. They furnish all the feed and the owner of the other half interest does the work. Tractors, corn pickers and all machinery necessary to carry on the farming operations have been purchased since acquisition of the farm.

Spurred with ambition and imagination, these two boys, Walter, Jr., 22, and William, 20, have proven that basic fertility is the only foundation upon which to build a farming career. Today they are growing more than 50 acres of corn, 20 acres of barley, five acres of oats and 60 acres of hay on what had been a discarded farm, to feed their 40 steers, 14,000 broilers and 70 hogs.

Both brothers have been active

in the Future Farmers of America and have served as officers in the Keystone Association. Walter, Jr., was chosen Star Farmer of the North Atlantic region at the 1945 National Convention and the following year William was accorded the same honor and in addition was awarded the highest recognition obtainable in the FFA —Star Farmer of America.

Radiant Heat in the Dairy Barn

Condensed from New Jersey Farm and Garden

Much has appeared recently on the advantages of radiant heat for the brooding of chicks. Now comes the story of its adaption to the dairy barn. Apparently it can become a patent factor in the control of mastitis, uniform production and general cow comfort.

The installation was made on the Highland Farm at Sharon, Conn., by Harry S. Norton, formerly of the Brian Boru Guernsey Farm in Somerset county.

Norton is convinced the system has cured one valuable seven-year-old cow of a chronic swollen quarter and feels that "the satisfaction of knowing the cows are always on a warm floor is worth the cost of installation and more."

The system consists of an installation of hot water pipes in the concrete floor of the newly-built barn, under the rear half of the stalls. No attempt was made to heat the barn itself. Rodney O. Unz, owner of Highfield, got the idea from some industrial applications of radiant heat and Norton laid out the system. Here are some claims he makes for it:

"Stalls and bedding are always dry. The stalls are eight feet deep by five feet wide. I have noticed that they are warm halfway toward the front. When we clean the gutters, they dry before we get done. Less bedding is required and on some cold mornings we have noticed that the cows are reluctant to leave their beds. Production definitely has been more uniform from day to day. On several cows, it varied only by tenths of a pound

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several days in a row. This often happens with a cow or two, but I never before noticed it with so many," the former Jerseyman declared.

"We have one Guernsey cow that had a chronic swollen quarter. She is valuable—producing about 10,000 pounds of milk and nearly 500 pounds of fat. We put her into this new barn January 1—that's when we started using it—and she has had no trouble since. We have had no trouble with any other cow, before or since."

Norton hasn't had a chance to check exact operating costs but thinks they are running "surprisingly low." The cost of installation, exclusive of heater, was under $1,000.

The farm's radiant heating plant is very simple. Two one-inch copper tubing pipes were laid four inches under the concrete and under the rear of the cows' stalls, one foot in from the gutter edge and one foot apart. There are 20 stalls in the 36x60 barn and less than 300 feet of tubing were needed. Protection was given where it was needed most under the hindquarters of the cows.

The tubing makes a complete circuit from heater back to heater, servicing the dairy as well. The heating unit is a small oil burner with circulating pump to force the water through the barn. Water temperature is kept at 150 degrees in the boiler. Floor temperature is controlled by the room temperature in the dairy, which is heated with radiators. This system isn't entirely satisfactory, however, on very cold days. So Norton plans to put the thermostatic control on the return line from the barn in order to boost the floor temperature a few more degrees.

The same furnace supplies hot water for the dairy, which uses a considerable amount since the farm retails all of its milk. The system is hooked up however, so that when hot water is drawn the floor line in the barn is not tapped. Norton said the radiant heat section of the system required only a slightly larger furnace and boiler — about enough to furnish extra hot water for a family of four persons.

Professor Bartlett, of the New Jersey Agriculture Experiment Station, said research already is underway to improve stable floors. He believes the new million-dollar agricultural research building already tentatively approved by the current Legislature, will speed progress along this line.

The dairy research chief thinks the Highfield Farm experiment is a step in the right direction. "What we would like to see is a uniform temperature of 55 degrees from below the floor to the

ceiling of the dairy barn," he explained. "Some type of radiant heat probably should be applied."

Use of radiant energy for heating homes and industrial plants has challenged researchers for several years now and is certain to be investigated, also, by the College of Agriculture when its new science building affords proper facilities.

Prof. Bartlett says thought is developing for the use in barns of heat waves induced by radio short wave. Physicians long have used this principle in physiotherapy machines. Prof. Bartlett says it may be possible to modify this principle in heating barns by placing electrodes beneath the floor and in the ceiling.

Every object between the electrodes—floors, stanchions, milking stools—would feel warm to the touch because they would absorb heat to a predetermined degree. In the case of barns, for instance, the thermostat would be set at 55 degrees. There will be many kinks to iron out first, but this indicates heating engineers are doing some streamlined thinking nowadays.

But that's still on the planning board, along with many other ideas for the benefit of dairymen.

The real and lasting victories are those of peace and not of war.

Emerson

The Soil — A Dependable Bank

Condensed from Fertilizer Review

Emil Truog

Professor of Soils, University of Wisconsin

EVERY owner of good farm land has at his service the most dependable bank and banker known—The Soil. It is not necessary for him to seek the advice of a city banker regarding safe investments. All he needs to do is by means of soil tests ask his own private bank and banker, the soil, what the needs are as regards additional working capital in the form of lime, organic matter and fertilizer, and then make his investments accordingly.

Now just why is the soil such a dependable bank as regards both safety of deposits and assurance of satisfactory dividends? Is it not true that grave danger usually exists of severe losses by leaching and fixation whenever fertilizer is applied to soils? Fortunately, recent research by means of chemical analysis, field and greenhouse tests, and X-ray and electron microscope studies are showing definitely that this is not true when fertilizer is judiciously applied to what may be called normal soils. Such soils are so constituted that the nutrient elements added as fertilizer are changed to forms which are largely non-leachable, but still available for plant feeding. Just how does a soil perform this apparent miracle? The explanation follows.

In the clay portion of soils there is present what may be called the miracle mineral. (Actually several minerals are involved, but since they are very much alike, they will all be included here under this one name.) The particles of this mineral are so fine that 10,000 of them can be laid side by side wthin a space of 1/25 of an inch. Being so very fine, these particles are everywhere present sticking to the surfaces of the larger soil grains. Chemically the mineral is called an aluminosilicate. It has a rather complicated chemical structure, is insoluble and very durable, and has the very special property of capacity for base exchange. By base exchange is meant the property which this mineral has of holding base forming ele-

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ments at its surface, such as calcium and potassium, and exchanging them for others, or the element hydrogen of acids.

The reason the miracle mineral can hold these elements, the atoms (ions) of which all carry positive charges, is because its surface carries a vast number of negative charges which thus attract and hold particles carrying the opposite charge. The laws of nature demand that all of the negative charges on this mineral be at all times satisfied or equalized by the presence of base forming elements or hydrogen carrying an equal number of positive charges.

Now just what has base exchange got to do with liming, fertilization, crop production and the soil acting as both bank and banker? Well, let us suppose the farmer has made an application (a deposit) of muriate of potash to his soil. Muriate of potash, being very soluble in water, would leach away if left as such. But the soil does not allow it to lie around loose as such any more than a good banker allows money to lie around loose in his bank. Wherever a grain of the potash salt falls, it dissolves in the soil water and forms such a highly concentrated solution within a little local area, that, by what is called mass action, most of the potassium forces an exchange with the miracle mineral, whereby the potassium becomes attached to this mineral (is put on deposit) and an equivalent amount of calcium or hydrogen is pushed out and enters the soil solution.

Thus protected against leaching, how can a crop obtain the potassium for its use? Here is how the transaction is made. The root systems of crop plants, each armed with billions of microscopic root hairs, present an enormous surface area which is everywhere in contact with the miracle mineral. Measurements by Dittmer of the extent of the root system of a four-weeks-old rye plant indicated that the total surface area exposed, including that of all branches and root hairs, was between 6,000 and 7,444 square feet. Now these roots, being alive, respire actively and thereby excrete large amounts of carbonic acid from this surface area. Wherever the roots are in contact with the mineral (virtually glued to it), a high concentration of carbonic acid is developed, and this by mass action forces some of its hydrogen to enter this mineral which in exchange allows some of the potassium to be liberated so it may be absorbed by the plant. In other words, the plant, acting for the farmer, presents, as it were a check in the form of carbonic acid at one of the windows of the miracle mineral,

which then delivers to the plant an amount of potassium corresponding to the amount of carbonic acid involved, providing, of course, that adequate deposits (applications of potash fertilizer) have been made by the farmer or are naturally present.

It is to be noted that all base forming elements in addition to potassium, such as calcium, magnesium, sodium, copper, zinc, manganese and iron are held in exchangeable form by this miracle mineral. Plants are able to liberate all of these for absorption by exchange of hydrogen present in the carbonic acid which their roots excrete. In time, this mineral becomes more and more saturated with hydrogen, and hence, more and more acid. In fact, when it is entirely saturated with hydrogen it is an acid; when entirely saturated with base forming elements, it is a salt; and when saturated partially with base forming elements, it is an acid salt. The greater the saturation with hydrogen, the greater the acidity and the more acid the soil. In time, this condition may need to be corrected by adding lime.

The calcium of lime enters the miracle mineral in much the same manner as potassium. Lime dissolves slowly in the soil solution, and then enters the mineral and forces out hydrogen. Thus the soil acidity becomes neutralized. A strongly acid reaction of the soil is, as it were, a signal from this mineral saying: "Your deposits, especially in the form of lime, are running awfully low. Better apply (deposit) some lime if you want to have those large lime checks honored that your alfalfa crop is attempting to draw on this bank."

Sometimes farmers ask if there is not some way of getting rid of soil acidity forever, so that liming might be dispensed with. From what has been said, it is apparent that this may be likened to getting rid of a bank by burning it down so that low and overdrawn bank deposits might be avoided. So all important is the function performed by the miracle mineral, that nature has made its performance doubly certain by providing that it may also be carried out by a substance of organic origin, humic acid. In fact, in peats and mucks, the function is performed largely by humic acid; in mineral soils, of course, largely by the miracle mineral itself. The very sandy soils often lack an adequate supply of both, and hence, are subject to severe losses by leaching. That is one reason why sandy soils are usually benefited so much by the addition of organic matter.

Now, what about the acid forming nutrient elements, such as phosphorus, which are not held

by the miracle mineral or humic acid? How are they held by the soil in a form that is non-leachable but still available for crop use? All good soils are so constituted that these acid forming elements may also be held in forms that may be likened to a checking account. Details of the exact mechanism involved are beyond the scope of this brief sketch.

Not only are normal soils so constituted that they hold nutrient elements in forms that may be likened to money on a checking account, but they also hold nutrient elements in forms that may be likened to investments in bonds and real estate. In these forms, it is true, elements have a lower availability than when held by the miracle mineral, but this is advantageous because it prevents loss by leaching that would take place if an excessive amount were held by this mineral.

Now what determines the forms in which a soil stores nutrient elements applied as manure or fertilizer? The answer is that the soil proceeds in much the same manner as a dependable financier: If a light or moderate localized application of fertilizer is made, the soil stores most of it in a form that may be likened to money on a checking account; if a heavier broadcast application is made, some is also stored away in forms likened to bonds and real estate; the heavier the application, the greater the amount stored in the latter forms. You will, of course, ask what happens to the elements stored in these latter forms? Do they again become available for crop use? The answer is yes.

Here again, the soil performs the job just like a good financier: As the amounts of nutrients in the form of checking account deposits become depleted by the growing crop, the supply is replenished by transfer from less available forms, just like the replenishment of a checking account through liquidation of bonds and real estate. Thus the soil maintains an even balance between the amounts of nutrients held in various forms much like the balance maintained by a financier between checking account funds and various less liquid investments.

Well, it is hoped that this brief exposition may give the reader a general picture of how a good soil functions in acting as both bank and banker for fertilizer elements that are added in order that these may be safely held and dispensed as needed for the growing crop. Of course, some soils, particularly the very sandy ones, have a rather low capacity (limited banking facilities) for holding fertility elements. That must be taken into consideration

when fertilizers are added. However, in the case of what may be called normal soils, the capacity exists to handle large additions of fertilizer in such a manner that the needs of large crop yields are satisfied without serious or appreciable losses. That leads to my closing remarks dealing with rates of fertilizer application.

If the soil is to do a satisfactory job of supplying crops with nutrients, then it must have adequate working capital in terms of plant nutrients. Some soils, even in their virgin condition, lack this capital with respect to certain nutrients. Many have it depleted by exhaustive cropping. Less than one-fourth of the soils under plow in the North Central States have adequate capital in all respects.

How should the deficit in working capital (plant nutrients) be made up? Should it be done by adding just a little fertilizer and lime each year for 10 to 15 years? Or should it be done by adding at once what is needed, and thereafter at frequent intervals enough for maintenance? Experiments in Wisconsin indicate that the latter procedure is preferable, because, it immediately doubles and trebles crop yields in many cases, and thereby greatly reduces the cost of production. The reason for this marked reduction is that labor is the main item involved, and this remains practically the same whether the yield be high or low. If you want efficiency in crop production, you must supply the soil with adequate working capital. Why follow a plan for doing this that takes 10 to 15 years? Can the farmer afford to wait that long before his labors become efficient? Certainly not.

Although it may cost $25 to $50 per acre to supply the soil at once with adequate working capital in the form of lime and fertilizer, it was found in the Wisconsin experiments that the increases in yield which resulted were produced at a cost for the unharvested crops of 10 to 15 cents per bushel for oats and corn, and $2 to $3 per ton for clover and alfalfa hay. The costs involved are those of interest on the investment for lime and fertilizer, and of a charge or reserve sufficient to cover the depletion of fertility entailed by the increased yields and not made good by the increased returns of crop residues and manure.

Some agronomists have objected to adding at once sufficient fertilizer to make up known deficits in the soil because of the danger of large losses from leaching and fixation. Fortunately, as already indicated, when what may be called normal soils of a favorable reaction are involved, this danger is not serious. "The earth commits no breach of

trust." In fact, the trend in many sections is already in the direction of these heavy initial applications. As soon as fertilizer supplies permit, this trend will rise rapidly because it will cut cost of production, improve quality and nutritive value of our feeds and foods, and greatly facilitate soil conservation.

Easy Way to Make Pork

Condensed from Capper's Farmer

Hog raising isn't much trouble for Karl Smith. He gets out of a lot of work just by settling for a single litter. And that means 1 litter a sow and 1 litter a year. It simplifies sow care, farrowing, pig tending, housing, feeding and expenses.

The first bother his system avoids is a pack of lumbering old sows. Gilts require less attention and they grow into pork as they head for the first and only litter. Just as soon as the pigs are weaned, the dams are put on finish feed. They do right well at pigging, too. He got 500 pigs from 81 gilts and said that was about average.

Farrowing comes in June. By that time there will have been 60 days or more of pasture vitamins, minerals and exercise for the gestating gilts. Such nutrients are more difficult to supply in a dry ration. And inducing adequate exercise during late winter before spring farrowing is not easy. But good pasture solves both problems and makes strong litters.

Early spring weather is as likely to be unfavorable in Smith's territory, Cass county, Michigan, as anywhere in the upper Corn Belt. So he just sidesteps it with breeding for June litters. That simplifies equipment and labor requirements.

Smith has three 80-acre fields. At least one is kept in alfalfa. Sometimes there are two and the third is in first-year seeding. Gilts farrow on alfalfa. If one picks an unfavorable location for her nest, Smith drives 3 steel posts, 2 in line and the other at the apex of a triangle. He has a number of 10-foot slat-panel

Reprinted by permission from Capper's Farmer, Topeka, Kansas, April, 1947

gates which are used for partitions in barns and sheds. One of these is laid flatside over the 3 steel posts which support 2 corners and the middle of the opposite side. Two or 3 forkfuls of hay or straw convert it into a shelter and shade.

Pigs are self-fed from the start. Sows are sorted out at weaning time, penned up for 5 days and then returned to pasture where they eat from the same feeders as the pigs. During suckling they are fed well and so don't lose much weight. About 30 days of finishing makes them ready for market.

Shotes get supplement made of 900 pounds equal parts ground wheat and barley, 100 pounds of a mineralized 35 per cent concentrate and 15 pounds of added mineral. The grain mixture prevents them from eating too much concentrate. They get corn from either self-feeders or from the field. They usually are about the right size for hogging down corn by the time it is ready and will average 200 pounds by January.

Gilts are bred to purebred Duroc or Poland boars. The breeds are alternated. He and 2 neighbors buy a boar apiece which are used interchangeably because each breeds at a different season.

Smith's cropping program is founded on his seedings. He is definitely casual about growing corn. Sometimes he doesn't plant any. It all depends on whether a sod is due to be turned under. Alfalfa stands 7 or 8 years until it fizzles out. Then he grows 2 crops of corn and reseeds with oats. The new seedings are pastured the second season, rested the third, pastured again the fourth. Hogs don't range any legume area 2 years in succession.

"I'm most concerned about plenty of pasture," said Smith. "If I have too much and some goes back into the soil, that's fine. It just banks fertility against future use, and it hasn't cost me much except taxes on the land. When I'm short, I plant 25 acres of rape early and put the later pigs on that."

During years when all his land is seeded down, he buys feeding corn from neighbors. In that section the crop is frequently soft or frosted. "With plenty of hogs around it gives me a chance to buy and use distressed feed," he explained. "It makes just as good pork, turns into just as good cash as if I paid a top price for it."

Most of this local corn comes in the ear. Smith stores it in 3 hog houses, 30 by 80 feet. About 30 feet of the length is left open as a feeding floor. That provides enough room for the shotes. As they grow, they eat their way into the corn for more floor space.

These hog houses have a 10-foot floor space on each side of a 10-foot alley. The entire floor area can be quickly divided into 10-foot units with removable gates. If the corn is shelled, it is binned in one end of the houses. Self-feeders are strung along both sides of the alley and replenished by truck. Or he may board the corn up in a 10-foot pen and open a slot to let it run out on to the feeding floor.

Sleeping quarters are provided in a barn. Bedding is stored on the same level and occupies most of the floor space. Hogs are kept out of it by a string of 10-foot panels. This is another labor-saving arrangement. Re-bedding requires only tossing straw over the fence. As the supply dwindles, panels are moved back and more space is available for the growing shotes.

Between the sleeping barn and hog-house feeding floors is a lane paved with old railroad ties. Water is automatically supplied both around the feeding plant and in the pastures. The system consists of a windmill and reservoir tank with 300 to 400 feet of pipe for the farmstead and 2 fields. The third pasture is to be supplied by driven well and electric motor.

When shotes hog down corn they continue to run on alfalfa. Gates and lanes are arranged for passage. In one case this involves a culvert under the highway. Smith sets his supplement feeders in a lot adjacent to the road and underpass where pigs pass them in going between fields.

Hog raising is a 1-man project for Smith. Under his system no help is required. Yet, he says tending 500 or more shotes is no trouble at all.

Record of Performance Lamb Production Project

Condensed from Sheep Breeder

Graydon Blank

Michigan State College, East Lansing, Michigan

ONE-HUNDRED pounds of lamb and wool credit per 100-pound ewe weight! This record was achieved by three Michigan sheepmen in the 1946 Record of Performance Lamb Production Project. Supervised by the animal husbandry extension service of Michigan State College, this project measures the efficiency of production of a farm sheep flock. It includes the annual wool clip and the weight of the lambs produced in 135 days.

Flocks are enrolled during winter and spring. After lambing dates are established, a weighing date for the lambs is determined 135 days from the average birth date. The total pounds of wool produced by the ewe flock is multiplied by three because normally the price of wool is three times the price of lamb. This wool credit is often added to the total lamb weight and the result divided by the annual average weight of the ewes which in turn gives the production per 100 pound of ewe. By this method all breeds and sizes of sheep are placed on an equal basis.

In the 1946 project, a flock of grade Oxford ewes owned by P. P. Pope and Richard Wheeler, of Mt. Pleasant, headed the list with a production of 104 pounds of lamb credit per 100 pound ewe weight. Twenty-nine ewes in this flock bred to a registered Suffolk ram dropped 48 lambs and raised 41. These lambs, averaged 90 pounds at 135 days and were ready for market. Good management practices were followed throughout in this flock. The ewes were turned on good pasture two weeks before breeding. The ram used was of good type and body conformation. The winter ration was made up of legume and mixed hay and a general mixture of salt, bonemeal and limestone, with phenothiazine added, kept before the ewes at all times. A small amount of oats was fed about one month before and after lambing. Individual lambing pens made from small

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gates and bales of straw, were available. Until the ewes were turned on pasture, the lambs could eat a mixture of bran, oats and cracked corn from a creep feeder. All lambs were docked and the ram lambs castrated soon after lambing. Summer pasture consisted of mixed legumes and grasses. Phenothiazine and salt at the rate of one to 12 by weight was kept before the flock at all times. The lambs were sold directly from pasture and topped the market without being fed any additional grain.

Two other flocks exceeded their weight in lamb and wool production. A flock of 106 Western ewes owned by Lester Allen, of Ithaca, and bred to Hampshire, Oxford and Suffolk rams, dropped 140 lambs and raised 129 to an average weight of 87 pounds at 135 days. These lambs also went to market without any additional grain. Leo LaPointe, of Branch, in Lake County, with 55 grade Hampshires bred to registered Hampshire rams, also exceeded the 100-pound mark. These ewes dropped 84 lambs and raised 72 to an average weight of 89 pounds.

At present market prices of wool and lamb, it is easy to see that flocks making records such as these are very profitable. The return per 100 pounds of ewe is over $20, while a 150-pound ewe returned approximately $30.

These high flock records are not accidental. They are the result of following good management practices including (1) flushing the ewes before breeding, (2) using a purebred ram of good type and quality, (3) feeding good quality legume hay and providing minerals, (4) providing plenty of exercise during winter, (5) using individual lambing pens for early lambs and giving careful attention at lambing time, (6) creep feeding lambs, (7) docking and castrating at an early age, (8) controlling ticks, (9) using Pheonothiazine and salt during the entire pasture season and (10) providing good pasture throughout the spring and summer.

Experience with Ladino Clover

Condensed from American Agriculturist

S. N. Stimson

Tioga County, N. Y., Farmer

I DO not own a plow and I have no intention of buying one. I own no cultivator, cultipacker or corn planter. We began putting up grass silage in 1936, and for five years our cows never ate a spear of hay. They were the best lot of cattle we ever raised—heavy producers with big middles and nice udders and nearly free from udder and breeding trouble. At the peak of production during the war period, we produced in a year over 100,000 lbs. of milk from 70 cows, 15 purebred cows for sale, 16 tons of poultry meat, kept 4,000 laying hens and packed 1,410 cases of eggs.

Let's go back to 1921 and see how this came about. In that year I started on these thin acres and the first year we harvested eight loads of daisies, paint brush and quack. We started a four-year rotation of corn, oats, and alfalfa for two years and were among the first in the valley to have alfalfa. This worked out well during the 1920's and we wound up by wintering 70 head of cattle and selling about 50 tons of hay a year.

Then came the depression. Fixed charges were the same, and with reduced income we had to do something and do it quick. We began to add poultry and convert barn space into quarters for poultry. That used up our hay storage, and, as I never liked to sell hay, I built my first 50x14-foot silo. It wasn't enough and the next year we built the mate to it.

To save labor, we put all our acres into Ladino and timothy. Alfalfa couldn't stand the competition and disappeared. Then we went after the pasture. We removed thorn apples, boulders and stumps, and leveled cradle knolls. We put on 2 tons of lime, 400 pounds of superphosphate, 10 loads of manure and 1 pound of Ladino clover seed to the acre. We wound up with three acres of buildings, 42 acres of planted trees, 54 acres of improved pasture and 60 acres of permanent hay. We clipped all the pasture every year.

With 3500 laying hens and about 70 head of cattle, we now manure every acre of permanent hay and pasture at least once a

Reprinted by permission from American Agriculturist, Ithaca, New York, Apr. 5, 1947

year, and to each load of manure we add 100 pounds of superphosphate. Our stands do not run out, the oldest having been in eight years. Feed Ladino and it will stay.

Grass silage is the most economical crop to produce and harvest in the Northeast. There is no secret to making grass silage. Molasses, acid, corn meal or what have you as preservatives are merely propaganda. In my opinion, the necessity for wilting to a definite moisture content is also "bunkum." Grass silage is what the name implies, a silage made from grass, not hay or weeds. The higher the protein content, the better the finished product. There is more danger of grass being wilted too much than of water running out of it, but if it is too wet, it makes us handle too many tons of water. A tight pack with minimum leakage is the main objective.

Good silos, concrete or tile, suit us best and we start filling the first week in June. After we start, we put in at least one load every day regardless of weather. This is necessary to avoid moldy streaks in the silo. If a field of grass looks like it is going to get too mature, we turn the cattle in to hold it back. We can pasture every field on the farm but one, and we clip quite a percentage of our pasture for silage.

Timothy, if cut when or before it heads, will produce excellent results, but we find timothy and Ladino our best bet. One pound of Ladino per acre and enough timothy to get an even distribution is sufficient on our farm. Our soil has long since had enough lime.

Four hundred pounds of 20% superphosphate will help the stand get established. Go easy the *first year* on manure, or Ladino will not stand the competition. After that, ten tons of chicken manure or fifteen tons of cow manure will keep the crop improving and will give one to seven cuttings a year, depending on weather conditions. We cut our poultry range seven times one year and the loader handled each cutting, but with difficulty because of the softness of the product. Ladino is a heavy feeder and its survival depends on early and frequent cutting so the competing plants cannot get the upper hand.

After ten years of climbing off and on a mower, we have learned a few things. We try and do our cutting *when the wind is blowing*. Whenever the *air is moving*, we stop everything and cut all we can handle before it gets too dry. Ladino cuts just as hard on a hot, muggy afternoon as it does in the rain. Young four-weeks-old Ladino cuts easily, but after that, more and more of it matures and joins previous accumula-

tions on the ground. By using rock guards and a power mower, cutting very close each time and following the procedure outlined above, we have taken the headache out of the harvest.

One of the cuttings after the first one each year should stand long enough so that a few seed heads will be shed for reseeding just in case the old stand takes too much of a beating the next winter.

We established much of our Ladino on pastures without plowing or dragging and have never used over one pound of Ladino to the acre. March is the best month in the year to sow the seed.

Grass silage will produce *more* milk with *less* grain than any crop we ever grew. Seasonal breeding troubles are reduced to a minimum, a big point in maintaining a fall dairy. Additional dry hay seems to make the cattle happy but adds nothing to their production, condition or general health.

After our silos are finally settled and full we make some dry hay. We don't consider it a necessity, but it saves all the crop and we feed it as a night-time snack. In the cattle ration it is comparable to pastry in the human diet. Grass is the ideal cattle food, and for winter feed, silage made from this same tender grass is the nearest approach to the ideal.

No more real service can be rendered than by improving agriculture.

George Washington

Hens Go to Summer Camp

Condensed from Everybody's Poultry Magazine

FRESH air and sunshine are two of nature's free commodities that are just as good for chickens as for humans. Every June we reward our hard working hens by starting them on a 4-month camping out trip. They return to their laying quarters every fall with a healthy just-back-from-vacation look and are full of what it takes to make breeders do a good job. We have no housing or management problem that makes it necessary for us to put our hens out on range each summer this way and we are not rewarded with higher egg production for it, but we do get better hatching eggs and, above all, the hens really seem to enjoy themselves. When we move these hens out to "camp" they take all their household belongings with them. The camp is set up in remarkably short time and taken down again each fall in equally brief order.

The facilities on range are simple and inexpensive. Shelter houses are not required and winter laying house equipment is taken out with the hens to serve practically all their needs.

The laying houses, thus completely vacated, are easy to clean and renovate for fall housing—or, if necessary, they are available for some temporary use.

Roosting quarters in camp are provided for by hauling the roosting pits out of the laying houses and placing them under "tin hats." A "tin hat" on our farm refers to a standard 8x10-foot wooden frame covered with corrugated tin. We have dozens of these and find many uses for them the year round. To provide cover over these roosting pits, we simply drive four 2x2-inch posts into the ground and set a "tin hat" on top. The "hat" is made secure to the posts by inserting a pin through the frame and post at each corner. Four sets of roosting pits provide accommodations for about 150 birds, which is about the average unit. The units are placed about 200 feet apart on the range.

When each unit is moved out, the birds are confined for a few days by a temporary fence erected around the roosts, nests, feeders, and waterers. After a few days in this restricted area the fence is removed and the birds have the freedom of the whole range. They have become so accustomed to their own facili-

Reprinted by permission from Everybody's Poultry Magazine, Hanover, Pa., Apr., 1947

ties by this time that very few of the birds wander off to other units. If they do, fights and arguments are bound to be started.

In addition to the dropping pits, other equipment also comes out of the laying house right along with the birds. The water founts are attached to the temporary water line laid on top of the ground, with a drinking font to each unit of birds. Nests are taken from the walls of the laying houses and hung up inside portable nest sheds. Each shed holds three sets of 10 or 15-hole nests hung on the two sides and one end of the shed. The attendant can gather the eggs without going inside the sheds by dropping a hinged board at the back of each row of nests.

The self feeders used in the laying houses are also brought to the camp. These feeders, made out of empty buttermilk barrels, hold a week's supply of both grain and mash. Feed is poured in the top and the birds eat it out at the bottom. No shed is needed for the feeders. A lid about 10 inches wider than the top of the barrel will provide sufficient protection for the feed in the barrel as well as that in the feed box at the bottom.

The birds are given free choice feeding on a come-and-get-it basis. We have found that on range we can obtain excellent hatchability on this free choice feeding but in confinement free choice fails. Aside from cutting the feed cost by 5 to 10 per cent, this foraging of hens allows them to pick up something outdoors the millers have not yet learned how to put inside the feed sack.

No cleaning is required in the camp except the removal of some of the droppings under the pits about the middle of the summer. The balance of the droppings left under the pits in the fall is quickly and easily taken care of by scattering it over the range with a drag at the back of our tractor.

We enjoy working with these birds when they are camping out because we enjoy the outdoors ourselves. Except on rainy days, it is much more pleasant than being cooped up inside a laying house with the chickens.

By using free choice feeding and these fountain type feeders, our labor cost is considerably reduced. When we haul feed it is to the wide open spaces with no doors to unlatch, no steps to climb, and no hard-to-get-at feed bins to fill. We simply drive the feed truck up beside each set of feeders and pour the feed in the tops of the barrels.

Total egg production for the year is probably a little less for these birds than for birds continued in confinement. This seems to be accounted for by their tak-

ing an earlier molt in the fall. Roosting outdoors naturally subjects them to some rough weather in September and October. While many birds continue to lay right on through the fall, the majority of them are induced by the weather to stop laying and start making a new coat of feathers several weeks sooner than they would if continued in confinement.

This does not worry us a bit, however, for all our eggs are saved for hatching. We do not depend upon market egg production and are not particularly interested in doing any hatching in the late fall months. By taking a rapid molt, these hens come back into laying form early and are producing chicks abundantly by the first of the year.

We have found that birds moved to range in June will show practically no interruption in their pace before fall but birds moved to range as late as August often take an immediate molt.

These "summer camp" hens give us better quality chicks, not only while they are on range in the summer, but during the following winter as well.

Some time in October, depending upon the weather, we start rounding up all our vacationers. Each is carefully handled and the best birds are selected to go back into the laying houses for another breeding season.

The nests are taken out of the sheds and hung back on their laying house walls. The barrel feeders are hauled back to their old positions in the houses, the founts are reinstalled, and the roosting pits are put back in their places.

All that remains to be done in order to completely break up camp is to take down the "tin hats," lift the water lines, and scatter the droppings left under the pits.

And thus another camping season has come to a close.

Sore Hocks in Domestic Rabbits

Condensed from California Cultivator

George S. Templeton

Director, U. S. Rabbit Experiment Station

SORE hocks, the inflamed or ulcerated areas on the undersurface of the hind feet or on the pad and toes of the forefeet of the rabbit, are responsible for considerable loss to the industry. These sore and tender areas cause suffering and loss of flesh, lower the animal's vitality, prevent normal development, prevent does from properly nursing their litters, and shorten the period of usefulness for herd bucks and breeding does. It is a condition that has developed with the domesticated rabbit for, in their natural environment, cottontails, jack rabbits, wild hares and snowshoe rabbits do not develop sore hocks.

For a considerable period of time a study of the problem has been under way at the U. S. Rabbit Experiment Station at Fontana, San Bernardino county, to determine, if possible, what factor or factors cause sore hocks; whether or not they are inherited and methods for treating them.

In this test the predisposing factors for sore hocks were considered to be the type of hutch floor and the moisture retained on it — environmental factors; the temperament of the animal, and density and length of fur on the pad—both inherited characters.

Wild rabbits living on natural solid floors of sod and soil do not develop sore hocks. For the hutch-raised rabbit, the nearest approach the breeder can make to this type of floor is a solid one, properly bedded and kept clean and dry. This involves too much labor for the commercial breeder so he has to make a choice between saving labor and having some cases of sore hocks among his rabbits. Wild rabbits developed sore hocks when kept on hardware cloth for observation.

Sore hocks appear on the hind feet of rabbits and as the sore areas on the rear feet increase and the cases become chronic, the animal changes its posture and throws more weight on the forefeet in an attempt to relieve pressure on those sore and tender areas. When this shifting of weight occurs, the forefeet become involved and sores then develop on the pads and between the toes of the forefeet.

Reprinted by permission from the California Cultivator, Los Angeles, California

The study showed that sore hocks are not inherited but that there are certain factors causing the trouble which are hereditary.

The more nervous rabbits were easily excited and active. They did a lot of stamping with the rear feet, bruised their hocks and thus were more susceptible to sore hocks than the less nervous animals.

As cases of sore hocks develop, the padding wears off and exposes the skin which becomes irritated. The tissues become bruised. The bare area becomes inflamed, abrasions occur in the skin, the tissues may become infected, and abscesses form. Rabbits suffering from sore hocks raise and lower the affected feet in rapid, successive movements and lie in such position that the tender and sore areas do not come in contact with hard surfaces.

Treatment: Rabbits that show signs of tenderness in their feet should be examined. If the padding is wearing off or the skin irritated, the animals should receive prompt attention. Solid-floor hutches should be well-bedded to keep the animal dry and clean. A portable self-cleaning lath platform should be placed in hutches equipped with floors of wire mesh or hardware-cloth, so that it may rest without the affected feet coming in contact with irritating surfaces. The platform should cover at least half the area of the floor. It may be constructed by placing two pieces of ¾ by 1½-inch boards on edge to form the ends, making the floor surface of lath, spaced ⅝ inch apart and nailed to the end pieces. The hutch should be thoroughly cleaned, be kept dry and in a sanitary condition.

Sore hocks may be treated quite successfully unless abscesses have formed. Adherent or adjacent matted fur should be clipped off; then the affected areas should be washed with warm soapy water, all loose scabs and debris being carefully removed. The parts should be dried well, and zinc or iodine ointment applied every other day until healing is well under way. Healing will take place more readily if the rabbit is confined in a pen on well-drained clean soil. In such a pen, mild cases of sore hocks will often heal without medical treatment. In the more serious cases where abscesses have formed, it would be advisable to destroy the animals unless they represent especially valuable blood lines or are to be retained for sentimental reasons. When it is deemed advisable to treat these advanced cases, the affected animals should be isolated in order to help prevent the spread of infection throughout the herd.

The abscesses should be freely lanced, opening them to the bottom of the cavity to insure proper drainage. Press out as much pus as possible and flush the cavity with any mild disinfectant solution or soapy water. The cavity thould then be swabbed, thoroughly but gently, with pledgets of cotton saturated in tincture of iodine. Examine the animals every other day to see that proper drainage is taking place and repeat the treatment as long as pus formation continues. Healing, to be permanent, must occur from the bottom of the cavity outward.

Sore hocks will respond to treatment better if the rabbits are fed a properly-balanced ration and are made comfortable. They should not be mated until all inflammation has disappeared and the infected area has healed.

In view of the fact that excessive weight is a predisposing cause for sore hocks, it would be well for the breeder to use precaution in rearing future breeding stock, not to develop the animals too rapidly or follow a feeding practice that would cause them to put on excessive weight or maintain it over an extended period of time.

Size in Bulls Pays Off

Producers of purebred beef cattle who have been listening to talk about "compact" and "compressed" types might well examine balance sheets of some commercial beef men before discarding their big, rugged stock. Kenneth Redfern, Des Moines county, Iowa, who produces both purebreds and market animals, would be glad to say a word for the big type. He had calves from 2 Angus bulls in his feed lot. Those from the big stretchy sire were judged 125 pounds heavier at the same age.

The big steers couldn't have competed with the little fellows in the show ring, but they turned grass and grain into more dollars. Every calf from a 1,600-pound show-type bull made slow gains; those sired by a 1,900-pound bull with plenty of scale, but few show-ring refinements, grew fast during the nursing period and put on flesh rapidly in the feed lot.

Capper's Farmer

Zoysia

Condensed from Farm and Ranch

Edgar A. Hodson

Zoysia is proving to be a highly desirable lawn grass for the South. This grass was little known in this country until a few years ago when the Alabama Experiment Station began growing it to determine its use and adaptability.

It is without doubt the very best lawn grass ever introduced or grown in the southern states. It is much superior to Bermuda grass or St. Augustine grass. It may be grown successfully on almost any kind of soil, and thrives in full sun as well as in the shade. Also, it will survive long seasons of drought fully as well as Bermuda grass, and takes very little watering.

However, Zoysia has been so widely popularized recently by favorable publicity that a word of caution is not out of order. It makes a very slow growth after being transplanted, so unless a solid sod is planted, the grower may be disappointed with the results.

It reproduces from runners which develop from the crown of the plant. There are no underground stems like those of Bermuda grass. Compared with Bermuda grass, the runners grow very slowly. A nursery row planted in 1942 developed a sod only about two feet wide by the end of 1946.

Zoysia stays green until late in the year. In fact, it requires a temperature in the low twenties to turn it brown. New growth starts very early in the spring. One of its most attractive features is that it has a very dark green color which it maintains all through the hot, dry summer weather and, in addition, it makes a thick, tight, velvety soft sod which feels to one's feet like walking on a well-padded carpet. It can be maintained in the very best of condition by a minimum amount of watering during the summer months.

For some reason, many people have the idea that a Zoysia lawn does not require mowing. This is not true. To have a good smooth sod, it needs frequent mowing. However, it is very easy to mow. If never cut, the maximum height is not over 4 or 5 inches.

Reprinted by permission from Farm and Ranch, Dallas, Texas, April, 1947

A Hired Man or More Machinery?

Condensed from Iowa Farm Science

J. J. Wallace

EACH year Iowa farmers are using more and more machinery. They are using it to make work on the farm easier. Many farmers also are buying machinery to replace hired labor. These operators are cutting the amount of labor used by boosting their investment in equipment.

Is this a step in the right direction? If Iowa farmers continue to do this, will they decide in a few years that they have gone too far in substituting equipment for labor?

Many farmers do not realize how far Iowa agriculture has gone in substituting machinery for labor. The table below clearly shows the trend. This table compares figures taken from summaries of record-keeping farmers in east central Iowa in 1932 and 1945.

Note that the organization of these farms changed little in the 13 years. The farms were the same size. They were cropped a little heavier in 1945, but the livestock program changed very little.

	1932	1945
No. acres per farm	246	246
No. crop acres	166	168
Corn acres	82	86
No. cows milked	8	7
Litters of pigs raised	24	26
Months of man labor used (includes operator and family)	25	19
Equipment investment (including horses)	$2,200	$3,284

We would expect that the amount of labor used would be about the same, too. That was not the case, however. In 1945, these farmers used 6 months' less labor than in 1932. On the other hand, they had $1,084 more invested in equipment.

The boost in equipment investment does not reflect the rising prices of farm equipment because of the way these men are making their inventories. Their equipment was listed at the actual purchase price. Then it was depreciated a certain percent of that purchase price each year. The current inventory value, therefore, is the depreciated value. It is unaffected by rising or falling prices of machinery.

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table is the inventory taken December 31, 1944. Undoubtedly the December 31, 1946, inventory would have been quite a bit higher than the one shown in the table. These farmers have bought a lot of additional equipment the past 2 years.

Here is clear evidence that farmers are substituting machinery for labor at an unusually fast rate. The reasons are fairly clear. Hired labor costs more than formerly. It is more difficult to get. Good hired men are hard to find.

Perhaps the most important reason is the social one. Farm families live more happily if they do not have an unmarried hired man living in the midst of the family circle practically every day of the year. This disadvantage is most important for families with growing children. Often the personality and character of the hired man is not what it should be. In short, the family is much happier without this "intrusion."

The case is far from one-sided, however. There are some shortcomings to this shift away from labor toward more machinery. As a farmer cuts down on the help used on his farm, it becomes more and more important for him to be constantly on the job himself. Farm work is made more confining and restrictive. It becomes more difficult for the farmer to leave his headquarters of business for more than a fraction of a day. If he gets sick or hurt, he has no one to take his place except members of the family—unless he wants to depend upon the helpful attitude of his neighbors.

Many jobs on the farm can be done better by two men than one. Building fences is an example. Two men can do more than twice as much as one man. These facts are well supported by statistical data taken from farm records. The farm management men at the University of Illinois even go so far as to say that a two-man farm is much more profitable than a one-man farm, regardless of the number of acres on the farm.

There is another alternative to this trend toward reducing the use of hired labor. I know of a hired man on a prosperous and successful New York dairy farm. This hired man is an agricultural college graduate. He and his family live in a modest but adequate house, some distance from the owner's house. Both houses have attractive surroundings. This hired man has a good garden. He gets $35 per week plus other privileges which usually go with a married man on a farm. These include meat, dairy and poultry products for the table.

Formerly he taught in the local high school. But he found that he could save more money after

he changed jobs. What's more he and his family are much happier. His family enjoys a satisfactory social standing in the community.

The owner of that farm has found it profitable to treat his hired man with the utmost consideration. He can leave the farm for a few days at a time. He knows that the work will be carried on as usual. This gives his family a chance to have a well deserved vacation. If he or his wife becomes ill there is always good help at hand without calling on the neighbors. This farm operator is confident that his hired man made him more money than additional investment in equipment.

We have many chances to repeat this picture throughout the state of Iowa. In ordinary times a satisfactory hired man's house can be built for from $1,000 to $1,500. Much of the work can be done by labor available on the farm. This amount of money will just about replace the extra equipment a farmer must buy who attempts to replace the hired man.

Furthermore, a hired man's house need not be depreciated as rapidly as farm equipment. The annual carrying cost of a house is much less than for an equal investment in equipment.

This is a long-time problem. It cannot be solved in a month or year. The present relatively high purchasing power of farmers encourages a scramble for more mechanical equipment. Perhaps it would be better, however, to think about alternatives that lead to better living conditions on the farm. These alternatives may give a higher earning power to the farm due to a more dependable and better type of hired man than we've known in the past.

The cultivation of the earth is
the most important labor of man.

Daniel Webster

New Weapons in Fighting Weeds

Condensed from Farm Journal

Ray Anderson

MIRACLES of weed control are strictly modern. We have near-miraculous concoctions today that leave certain desirable plants unharmed, yet slay the weeds. We have flying machines to scatter the stuff. Other contrivances, new and old, spray, dust, cut, uproot, flail, scorch, even electrocute unwanted plants.

We have farming and grazing systems designed to keep ahead of weeds. Above all, we're organizing better than ever before to battle weeds.

Weeds nearly got out of hand during the war when farmers were too busy and too short-handed to do much about them. Also, soil fertility slumped, and weeds promptly took advantage of that.

At a recent weed conference at Des Moines, attended by scientists of 29 states and Canada, the most discussed control method was that wonder-chemical, 2,4-D. It was agreed—but with reservations—that 2,4-D is great stuff for control of broadleaf weeds in turf, other non-tilled areas, and in "tolerant growing crops."

Caution was urged if it is used too heavily on bent grass or buffalo grass lawns, because scientists are not sure these grasses are 100% resistant to 2,4-D. They're sure enough, though, that it plays hob with alfalfa, red clover, white clover, alsike, sweet-clover, field peas, soybeans, cowpeas, the vetches, and other legumes.

On the other hand, tests at the College of Agriculture in Berkeley, Cal., last year showed that weeds and unwanted grasses can be killed in alfalfa fields with special herbicides and diesel oil *if* the *right amount* of the *right material* is applied in winter. For most farmers, 2,4-D appears risky in alfalfa until more research is done.

When it comes to the grain members of the grass family, like oats, wheat, and barley, 2,4-D may add still another operation to the farmer's work.

One of these days he may be running through his small grain fields with a sprayer to knock out wild mustard and other weeds—unless, of course, he has a legume coming on. Or he may use an airplane.

At current prices, the 2,4-D

Reprinted by permission from the Farm Journal, Philadelphia, Pa., March, 1947

needed to rid a small grain field of weeds costs less than $1 per acre. If the farmer already has spraying equipment, the total cost for material and labor would be less than $3 an acre. Grain yields have been doubled in some cases by killing weeds, especially in wet years. In dry years it might not pay.

If the grain is to be used for seed, farmers are cautioned not to use too heavy solutions of 2,4-D, as germination might be lowered.

2,4-D knocks out bindweed, dandelions, plantain, and poison ivy. Three to five sprayings of it kills Canada thistle. It won't damage most grass, nor sterilize the soil. It's non-poisonous, non-inflammable, and won't corrode metal.

At Des Moines, the scientists made a list of weeds and woody plants that are "susceptible," "intermediately susceptible," and "resistant" to 2,4-D. Your state Extension Service, or County Agent, probably has this list.

For the best job, 2,4-D should be used when the weed is actively growing. But watch the wind when spraying, lest it drift and damage valued plants.

One thing still to be learned is whether 2,4-D may be combined with an insecticide and a fungicide to battle three pests at once. Last year such a 3-way spray was tried on potatoes in Iowa. Results looked promising.

Several chemicals besides 2,4-D are used to fight weeds such as sodium chlorate, salt, borax, the arsenicals, and sodium dinitro-orthocresylate (Sinox). A brand-new one is sodium pentachlorophenate, which works with onions. 2,4-D is fatal to them.

Last season A. L. Bakke, of Iowa State College, killed weeds in a 2-acre onion field by cultivating once with a new-type rotary vegetable weeder, and by spraying twice with sodium pentachlorophenate. He got four-fifths as many onions as from hand-weeded fields, and he took the stoop labor out of onion care. That paid, because *the chemical application cost only $3 an acre compared with a minimum hand-weeding cost of $75 an acre!*

Returned G. I.'s and others will push custom spraying of 2,4-D this spring. Numerous spray mixtures will be on the market. I know of 30, and that probably isn't half of them. They vary from 7% of 2,4-D to 83%, so be sure to read the labels.

Now about new machines? Most weed-control tools are well known and still mighty useful. Don't junk them—not even your hoe and scythe. But among the newer machines is the flame cultivator, used in cotton and a few other crops.

If you're interested in building your own "flame-thrower," write to the Wyoming College of

Agriculture at Laramie for Circular No. 75, "Control of Noxious Weeds by Light Burning, and How to Make a Burner."

Some surplus war machines, like decontaminators, flame-throwers, and pressure sprayers, are now in the hands of county Extension Services for weed and insect control.

You can also get several machines for mowing fence rows and other hard-to-get-at places. The University of Illinois at Urbana offers suggestions in Circular No. 591, "Home-made Power Cutters for Weeds and grass."

Factory-made sprayers now are available again, and they're better than ever. They range from small knap-sack rigs to huge power outfits. Some are "general purpose," in that they may be used on livestock and fruit trees, or to paint the barn, as well as on weeds.

But weeds are like contagious diseases—you can't leave the fight entirely to individuals. That means community organization, and we're making progress there, too, especially where bindweed is bad. Nebraska pioneered the weed district idea; now Wyoming, California, and other states also have similar laws.

In the Scotts Bluff, Nebr., district in 1945, average cost of 2,4-D spraying for bindweed and other weeds was $14.48 per acre. This is not high, considering that bindweed can almost ruin a farm.

South Dakota recently began a program which promises to sidestep the political inertia of weed commissioners, which is often a severe headache in many states.

Heart of the South Dakota scheme is a system of three-man county weed boards (35 of them now) elected by community weed board members. The community boards are chosen by farmers in meetings staged by the State College extension service.

These boards set up the program, plan the attack, and then depend on voluntary "weed rings," (ten or more neighbors) who buy herbicides and equipment co-operatively. A State Weed Board establishes policies.

Education is the key to this plan, contends W. W. Worzella, head agronomist at South Dakota State College. He says that it is usually futile to try *forcing* farmers to control weeds, but that practically any man can be *persuaded* when he sees what weeds cost.

And what do weeds cost? Some estimates put it at an average of $450 per farm annually, and a total national cost of 3 billion dollars a year. However, there is no way of proving the figures.

But you know yourself what weeds cost *you* in time and toil, poor yields, lower quality of crops, and damage to livestock

and livestock products such as wool—to say nothing of wear and tear on your good nature.

The best weed control tool of all is still good farming and common-sense handling of soil and crops. Given that, plus these new methods, and we may wind up with a sure-enough modern miracle.

Kentucky's New "Wonder-Grass"

Condensed from Kentucky Farmers Home Journal

W. G. Duncan

ALTHOUGH Kentucky 31, the grass that is giving everyone in west Kentucky "grass fever," did not actually start growing in Christian County, a combination of circumstances there gave it its start. The history of Kentucky 31 is a curious mixture of circumstances that kept it from being lost, and kept it from being found or noticed.

It was over forty years ago that Mr. Suiter, plowing his steeply sloping field one fall day, ran his plow into a patch of grass that was greener than anything else around and such a thick heavy sod that his plow hung in it. Instead of plowing the grass up and out of existence, Mr. Suiter used his eyes to notice that the grass was green and had made great growth on the poor field; and he wisely decided to plow around the grass and give it a chance to see what it could do. He watched it thrive and when it ripened he painstakingly saved the seed by hand, and that fall planted another patch of the grass.

Mr. Suiter saw this grass grow faster than any other grass he had ever seen, until his fall planting became a vivid green patch on an otherwise dreary hillside. He pastured it and found that his livestock ate it with relish. He looked at the older patch and saw that it had covered the ground with a sod so heavy that erosion was no longer possible even on his slopes, and he, like many

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others since, came down with an acute case of "grass fever." It wasn't long until his entire farm was covered with the new grass and he found that he could keep more livestock fatter with less feed and hay than he had ever believed possible before.

One would have thought that Mr. Suiter's neighbors would have immediately followed his example, but they didn't. Suiter's little mountainside farm, although green all the year 'round, was surrounded by farms that changed from green to brown with the seasons. Suiter sold a little seed, but it all had to be gathered by hand from fields far too steep for any machinery, and besides that, Mr. Suiter wasn't much interested in selling seed, so for many years news of the grass didn't get circulated beyond the neighborhood.

It was in 1931 that this grass was first seen by a representative from the Kentucky Experiment Station, hence its name, "Kentucky 31." Some grass and seed were taken to the Experiment Station where it was identified as a kind of fescue. It might have started on its rise to fame at this time but the discoverer was busy on other projects so the grass was pigeon-holed for eight years.

Then in the winter of 1937 Bill Johnstone of the Experiment Station was in Menifee County conducting one of his meetings. After the meeting, Bill was looking things over and indulging in his favorite worry about how to keep Kentucky from washing away by inches every winter, when he looked across a valley and saw a green farm hanging on the side of a mountain. The surrounding farms and all the rest of the farms Bill had seen that day were brown or red or yellow, it being that time of year, so Bill just stared at that green farm. He decided he had to have a closer look, and never was there a trip more worthwhile to Kentucky farmers. For when Bill Johnstone reached that farm which should have been as poor as the farms around it, he found a farm half knee-deep in rich green, a farm where erosion was no longer a problem, a farm with fat cattle and empty corn cribs.

Bill marveled at what he saw and didn't leave until he had the promise of some seed to test in other parts of the state. Back at Lexington, he found out what sort of grass it was, and started some tests. Though the results were not as encouraging as he had hoped, Bill still had faith in the grass. He continued to arrange tests all over the state, but he didn't ring the bell until he talked to County Agent W. D. Talbert, in Christian County. Bill Talbert was looking for something to cover Christian County's nakedness in the winter.

In addition, he had a little T. V. A. Demonstrator's Fund available to buy a hundred pounds of the grass seed from Mr. Suiter, and he had in mind an unusual family of farmers, the Arvin brothers, whom he felt would do a good job of trying the grass out and would also watch the results.

The Arvin boys did give the grass just the sort of trial it needed. To show how good a job they did, they borrowed a nine-foot cultipacker with a grass seeder attachment from the writer, and carried it fifteen miles to use in sowing the seed. They had a good place to try it because their land was thin and badly washed in many places—not poor land, but land that had grown too much corn, not steep but not level enough to grow corn without washing off some soil with every crop.

The seeding at Arvin brothers had a hard time. It was late planted and dry weather kept it from starting off when it was planted. The winter was a bad one and much of the grass was lifted out of the ground by frost. The stand was so poor the next spring the Arvin boys talked about plowing it up, but they decided to let it stand and managed to save a little seed from it. As the summer progressed, the grass kept looking better and better so they sowed their seed on several different plots, and under various conditions.

Lee Morton, acting on the advice of County Agent Stuart Brabant, planted the seed on sixteen acres of low wet land. It got off to a good start and then the elements conspired against it. A neighbor who passed the field every day said that he believed it was under water more than half the time; not long floods, but often lasting a week at a time, all through that winter. In the spring it grew up to be an outstanding field and made over $9,000.00 worth of seed which tested 96 per cent pure.

Jere Jones, manager of the local Borden plant, sowed an acre or two in May and lost it for the summer in a mass of weeds and crab grass; but in the fall and winter it was the greenest spot on the farm. On farms in and around Christian County many others tried the wonder grass under all sorts of conditions and found it to be the answer to most of their permanent pasture problems.

The growers in the county, prodded by Bill Talbert and Bill Johnstone, realized that some way had to be found to answer all of the letters that were coming in asking about the grass, and some way had to be developed to tell what had been discovered about how and when and where to plant the grass. This resulted in the

growers forming a group known as the Kentucky 31 Fescue Association which published an informative leaflet and endeavored to set some standards of quality for the seed.

What is there about this grass that is so different from all other good grasses? Why is everyone so enthusiastic about it? What is its future? These are the questions being asked and answered by farmers all over the Pennyrile.

Grass-minded farmers, comparing Kentucky 31 with orchard grass, find that although it looks like a bunch grass, it spreads, unlike orchard grass, to produce a true sod. In very hot dry spells in midsummer when orchard grass shows little or no green, Kentucky 31 continues to grow.

Brome grass enthusiasts still argue on even terms with Kentucky 31 fans when they talk about grass on level land high in fertility and moisture, but when the discussion gets to poor land, medium land, hillsides and fields of varying fertility, brome grass boosters admit defeat.

Blue grass gave its nickname to the state, and as an ornamental ground cover for a lawn or a horse farm it has no superiors. It cannot compare, however, with Kentucky 31 as an income producer. Not only will Kentucky 31 grow where blue grass would fail, but it will produce several times as much good grazing and all the year around.

Red top, timothy, rye grass, and others each have their place and fill it well but when it comes to creating a permanent pasture, Kentucky 31 is beyond comparison with them.

How Much Will He Weigh?

Condensed from The Hereford Journal

J. L. Foust

Owensboro, Kentucky

THE importance of checking livestock weights is an old story to most every farmer and prize breeder. But while most farmers are well aware of the need for checking these weights very few have ever been able to do so within the limits of their own property.

It is a recognized fact that different types of feed or silage have varying weight-building factors. The wise stockman or prize breeder is usually very careful to see that the most productive type fills his feeding troughs. However, without some method of accurately weighing cattle, hogs or sheep, he can only guess at the weight increase. In so doing, he can never be certain that he is feeding the best mixture for maximum results.

It goes without saying that a reliable scale is a real necessity on every farm. Most farm homes do have a low capacity scale, but probably not one in a hundred can boast of a unit capable of weighing cows, hogs and other livestock. The usual practice is to utilize the local highway scale, the grain-store scale or the scale at the nearest stockyards. This is a laborious process and time-consuming, especially in the case of the prize-stock breeders who carefully watch weight increase from day to day.

It is a recognized fact, too, that cattle can carry disease. Perfectly healthy cows can be easily contaminated at public scales. Farmers who take pride in raising healthy cattle and in keeping clean barns can lose heavily by a single infection at the public weighing place.

There has lately been announced an instrument known as a dynamometer which is essentially a high-capacity scale. This unit looks somewhat like an oversized alarm clock and has the distinct advantage of being highly portable and light in weight.

Such dynamometers have long been known in the scientific world for their extreme accuracy in important research and field-test work. They are used in hydraulic mechanisms, testing machines, wire-testing devices, and many others. Their big advantage lies

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in the fact that they can register a tremendous load from zero up to as high as 20,000 pounds if necessary. Yet they are themselves only 8¼ inches long x 6¼ inches tall x 3 inches thick. Weighing only 8 pounds with attachment shackles, these dynamometers are very easy to move around on the farm wherever they may be needed.

Since livestock weighing seems to be about the most important use to which the dynamometer scale can be put on the farm, we would like to describe here the method used by the writer in actual tests with various types of stock.

A wooden cage or box was constructed of ordinary pine boards such as are available on most any farm. This cage was slatted to reduce weight and increase handling ease. Both ends had hinged gates. Our initial tests were with a heavy bull. He had no hesitation about entering the cage as it was open on both ends. As soon as he was well in, both gates closed holding him stationary.

Previously we had felled two rather tall trees and erected two posts made from them, one on each side of the cage. A cross-support was added at the top. To this we attached an ordinary chain hoist with the dynamometer scale between it and the cage. It was then only a matter of a few seconds to lift the cage with the bull in it and read his weight. Of course, we deducted the weight of the cage which was about 250 pounds.

To drive the bull in and obtain his weight was a matter of about two and one-half minutes in all. Later, we weighed 16 head of young cattle individually that we were taking to market the next day. This was done with dispatch, and the weights checked with the stockyards scale satisfactorily.

Two or three milk cows were weighed one at a time with no difficulty at all. These could have been weighed at one draft if we had so desired. We also led a horse into the cage with ease. Finally we weighed 25 hogs in record time. The same cage was used; however, it would be advisable to have two cages available—a small one for hogs or sheep and a large one for cows or horses.

Since our initial tests we improved upon the original setup by leaving the cage permanently suspended from the top beam with the scale still in series. Two small inclined ramps were made for the ends of the cage so that the cattle could be driven up one end and into it. After weighing, they came out and down the ramp on the opposite side. Thus it was unnecessary to raise and lower the cage each time. It was

simply left in suspension. This arrangement does away with the cost of a chain hoist so that the only expense involved is the dynamometer scale and the cage. We figured the cage cost about $10 for materials—an inexpensive investment.

Dynamometer scales of this portable type do not cost a great deal of money. Further, they have been designed for rugged use in all kinds of weather. Operating on the principle of the "bending of a beam," they do not depend upon springs for accuracy. This means that even very extreme temperature changes do not affect the readings.

The dynamometer used in our tests is equipped with a red maximum hand that remains at the top load making it easy to check back on each reading. The dial is protected with thick, shatterproof safety glass, and the figures are large, making it easy to read even from a considerable distance.

In farm work it is often necessary to check the draw-bar pulling power of tractors or trucks. The dynamometer is especially suited to this task also. It is simply hooked between the tractor and some stationary object such as a tree. The tractor is driven ahead under full power until the engine stalls. Pull is automatically indicated in pounds by the red maximum hand.

Then, too, there are dozens of odd weighing jobs to be done on an average farm. Many of these are in locations where an ordinary scale would be out of the question. The portable dynamometer can be taken into the barn or out into the field wherever the job may be. A collapsible tripod can be quickly set up, providing a high-capacity weighing unit when and where it is needed.

Of course, the most valuable application for such instruments is undoubtedly livestock weighing. The convenience of high-capacity weight indication at a low cost cannot be over-estimated. For the average farmer, a useful instrument of this kind would soon pay for itself in time savings, convenience and general farm utility.

Blue Lupine in the Southeast

Condensed from Soil Conservation

R. Y. Bailey

Chief, Regional Agronomy Division, Southeastern Region, Soil Conservation Service

A TOTAL of 37,300,000 pounds of blue lupine seed was harvested in Georgia, Alabama, and Florida in 1946, according to the Bureau of Agricultural Economics. Lupine took its place among the leading winter legume cover crops.

The Soil Conservation Service had an important part in achieving this remarkable record. Its interest is sharpened because blue lupine is filling such a vital place in soil and water conservation programs on the sandy soils of these three States, especially where peanuts are grown.

The luxuriant growth of lupine at the North Florida Experiment Station at Quincy, Fla., early in the spring of 1937 impressed Service representatives who visited the station. They thought that the plant might be the answer to a long-felt need in the deep South for a winter legume that would make early spring growth in time to be turned under for early planted crops, and that would produce seed.

The Service arranged to get a few hundred pounds of seed in the fall of 1938. This seed was planted in the demonstration project at Greenville, Ala. Results were sufficiently promising to warrant further plantings elsewhere.

In the fall of 1939, we purchased 1,500 pounds of seed with CCC funds and distributed 500 pounds to each of three CCC camps assigned to the Soil Conservation Service and working in the Coastal Plain of Georgia, Alabama, and Mississippi. In spite of the severe winter of 1939-40, the lupine made fair growth at Perry, Ga., and Dothan, Ala. Severe freezes damaged the plants at the Collins, Miss., camp to such an extent that local personnel decided lupine was out of its range over there.

Additional plantings were made in Georgia and Alabama in the fall of 1940 with seed harvested the previous spring. Several farmers had become sufficiently interested in lupine from observations they had made of the plantings that survived the severe freezes of January, 1940,

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to purchase additional seed from Florida that fall and again in the fall of 1941.

After this country entered the war, there was an immediate demand for greatly increased production of peanuts for food and other purposes, and a heavy burden was placed on the erodible sandy soils of the peanut belt. Soils left bare by the harvesting of peanuts proved highly susceptible to erosion, particularly sloping land.

Farmers and others in some of the principal areas of peanut production became alarmed over the severe land damage that might result from several years of intensive cropping of large acreages. They had grown peanuts in the past, but the acreage had been hogged off so that the vines were left as a protective cover on the land. The largely increased need for peanuts would likely expose too large a proportion of the land to both erosion and depletion of organic matter.

Thus it came about that Soil Conservation Service was called on to take immediate steps to get some kind of cover on the land after the harvesting of peanuts. A committee of interested people went to Washington and talked with the Chief of the Service. They had a serious problem on their hands and they required help immediately.

In the spring of 1942, a conference was called at Spartanburg, S. C., to find ways for meeting this need. Representatives of the Washington, Regional, and area offices spent 2 days in formulating a plan of action.

Following this meeting in the regional office, tentative outlines were developed for several kinds of field plantings of different winter crops that might provide ground cover following harvesting. Agronomists from Georgia, South Carolina, and Alabama met with representatives of the Washington, regional, and area offices in June, 1942, to lay out a program.

In the fall of 1942 the Soil Conservation Service purchased sufficient blue lupine seed, Austrian Winter peas, and oats for observational plantings in the principal peanut-producing areas of Georgia, Florida, and Alabama. Several different seeding methods were tried. These included seeding ahead of harvesting peanuts so as to allow cover-crop seed to be covered by the digging operations. Different methods of seeding immediately following the harvesting of peanuts were also used. And various dates of seeding were tested.

As has been pointed out, it is common practice in the runner-peanut areas to glean peanut fields with hogs after peanuts are picked from the stacks in the fall. We could not ask farmers

to keep hogs out of the fields, because they depended on the gleanings for a considerable part of their hog feed. Also, the pork that could be made in this way was as necessary in carrying on the war as were the peanuts.

We decided that unless sufficient roots could be developed while peanuts were in the stacks, to survive the gleaning by the hogs, we could not hope to succeed with cover crops. Consequently, we asked farmers to subject fields where cover crops were seeded to normal gleaning by hogs, so that we could see whether any cover crops would survive.

Blue lupine came through the gleaning period surprisingly well. Although many of the plants were destroyed, a great many others survived and provided considerable protection during the winter and either a seed crop or a green manure crop in the spring. Early plantings survived much better than late plantings. Lupine usually made the best showing among the cover crops.

Farmers in the Wiregrass Soil Conservation District of Alabama were more successful with their cover crop plantings in 1942-43 than those in the Georgia and Florida districts. We studied field results in all three States and tried to learn why certain plantings had failed and others had succeeded. Numerous photographs and notes helped to explain the reasons for success or failure.

Lantern slides made in Alabama where plantings were successful whetted the determination of farmers in Georgia to try again in the fall of 1943. Additional seed was purchased by the Service for use in Georgia, Alabama, and Florida in the fall of 1943. Cooperative field trials were planned with state experiment stations and extension services in 1943. It was interesting that farmers in those communities in Alabama where the 1942 plantings were successful were not interested in seeing trial plantings made in their communities in the fall of 1943. They were convinced and fully ready to go ahead with planting their entire acreage of land from which they were harvesting peanuts that fall. Several farmers who began with small patches in the fall of 1942 planted all of their 100 to 200 acres of peanut land to blue lupine in the fall of 1943.

Largely as the result of the influence of regional technicians of the Service, and the harvesting of lupine seed at one of our regional nurseries, additional plantings were made in southern Mississippi in the fall of 1945. These plantings were successful, and, as a result, we have received a report that the work group of Lucedale planted 235,000 pounds of

lupine seed in the fall of 1946.

We have shipped lupine seed from the Southeast to interested farmers across the river. In the spring of 1944, Grover Brown spent 10 days in the peanut belt of Georgia, Alabama, and Florida. As a result of what he observed in these States, he discussed blue lupine in portions of Texas where he thought it might grow. Press releases indicate that farmers, county agents, and others are waxing enthusiastic about lupine's future out there.

One of the problems that we face now is to get lupine fitted into a soil and water conservation program. We must guard against allowing it to become the entire vegetative program in areas where it is important. The crop grows so well and stirs so much local interest that it may be allowed to overshadow other necessary phases of a vegetative program. It fits almost perfectly as a cover, following harvested peanuts, and should have a place in areas where it is adapted, wherever annual winter legumes are planted in the fall and turned under in the spring. Its ability to make seed that can be harvested each spring is particularly important in areas where farmers spend money each fall for cover crop seed.

The rapid increase in seed production indicates that blue lupine may reach the hundred million mark within the next 5 years. The sandy lands of the Coastal Plains need several hundred million pounds of lupine seed annually.

The Soil Conservation Service derives considerable satisfaction from having pioneered the introduction of this valuable legume, following the work of the Florida Agricultural Experiment Station in making seed available and in showing us the possibilities of the crop. Our regional type of organization was a distinct help in blue lupine's wide distribution, for when the legume failed in one State we used the result in another State to encourage further trials.

Limited Trapnesting

Condensed from American Poultry Journal

G. T. Klein

Massachusetts

THE forward surge in the Nation's average egg production has been due in large measure to scientific breeding. It would be difficult to estimate the financial value of this to the industry, for it is an astounding figure.

One of the unusually high expenses of the breeding program is trapnesting. Before World War II, it was estimated to cost no less than a dollar a bird a year. This may be as high as $1.25 or $1.50 now. In addition, there are added expenses for record keeping and the like. It is important to examine trapnesting and to see if there are savings that can be made.

Dr. F. A. Hays, poultry geneticist, Massachusetts State College, recently spent considerable time studying trapnest records. He arrived at some definite conclusions regarding the limits to which one could go in cutting this expensive phase of breeding. This is a report of his conclusions.

First, it should be said that the inheritance of high egg production is complicated. A yearly record depends upon such characters as age at sexual maturity, intensity of laying (rate of lay), winter pause, egg size and character, broodiness, spring intensity of laying, summer intensity, spring and summer pauses, fall intensity and persistency. The work of Dr. Hays shows that these characters are all definitely yet independently inherited. To get full information on each of these characters requires year around trapping. Yet let us examine Dr. Hays' findings and see what information can be obtained by trapping at various times of the year for short periods.

In studying limited trapping, Hays used the records of 1,684 production Reds made during their first laying year. All birds had been bred for high egg production. The pullets were hatched in March and April. The study was made using 5 plans for limited trapping—

1. First two days a month beginning Oct. 1 and ending Sept. 2.
2. First week of each month beginning Oct. 1 and ending Sept. 7.

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3. Daily during October.
4. Daily to Jan. 1st.
5. Daily during August at the end of the year.

The information desired included these 5 points—

1. Estimate of the probable annual egg record.
2. Probable egg weight to Jan. 1st.
3. Probable hatching season egg weight.
4. Probable annual egg weight.
5. Probable winter clutch size.

When the records of the first 2 days of each month were totaled and multiplied by 15.2, the factor necessary to get the total year's record, the estimated production was found to be 96% accurate. This is close enough to serve for the annual egg record. If a breeder selected hens that laid 14 eggs on the 24 days of trapping, they would be expected to lay about 215 eggs in a year. The 250-egg bird would have to lay about 18 eggs.

Trapnesting for a full week each month was but slightly more accurate than 2 days. In this case, the number of eggs laid on the days of trapping is multiplied by 4.34 to get the yearly record. It is about 97% accurate. It has but slight advantage over trapping for 2 days a month.

Trapnesting during October alone was not found to be accurate enough to be used.

Trapnesting during August at the end of the year was found to be very accurate. It also gave the necessary information on persistence or length of the laying year. In this case, the number of eggs laid during August is multiplied by 11.77. It gave accurate indications of the yearly record and is rated as extremely reliable.

Trapnesting from first eggs through December is accurate, but it does not give information on persistency and some of the characters that trapping 2 days a month or during August gives.

There are a number of plans for obtaining an accurate estimate of the annual egg weight. Weighing eggs 2 days each month, one week each month, 2 days a month or one week a month during October, November and December, or during the month of October.

Trapnesting for the first 2 days of each month and for the first week of each month from October through February give a reasonable measure of winter intensity. Neither October nor August trapping give information on winter intensity.

And so Dr. Hays concludes that limited trapnesting gives a considerable amount of reliable information for the breeder, but that it is not so accurate as yearly trapping.

I personally can see many possibilities for its more extensive use. One of the best known

breeders of Massachusetts, whose contest records rank among the first 5 of the Nation, developed his strains of Barred Rocks and of Reds by limited trapping. When he became a member of R.O.P., it was necessary to go to year around trapping.

Limited trapping can be combined with culling and selection, and practically all information can be obtained that the breeder gets from all year trapping. This trapping might be 2 days a month, one week a month or trapping during August. Our observations indicate that it does not upset a flock to use the traps 2 days a month and not the remainder of the time. Trapnests can be locked open on days when they are not in use.

The information which can be obtained by culling without trapping includes these points--

1. A separation of the flock into early and late maturity. It is important not to use the late maturing birds for breeders or the extremely early maturing ones.

2. Birds which go broody. These can be designated with a leg band.

3. Persistency or length of laying year. The desirable breeders are those in production in late August or September.

If the above information is supplemented with that on intensity of laying, egg size and quality, the breeder has about all the information that is obtained from all year trapping.

It can be especially valuable to a poultryman if he uses limited trapping to pick the breeding females. These could be mated to pedigreed males purchased from a breeder who does yearly trapping. From this mating, the poultryman could produce the cockerels for his flock exclusive of the breeding pens.

Proper Livestock Feeding

Condensed from American Hampshire Herdsman

F. B. Morrison

Cornell University

THE numerous discoveries that have been made during the past ten to twenty years in livestock feeding have overturned many of our former opinions. Such discoveries have been made especially concerning the various vitamins, and concerning minerals, proteins, and hormones. As a result of these discoveries, livestock rations that were considered satisfactory fifteen to twenty years ago can sometimes be radically improved.

Livestock not only produce at a higher level when fed rations which provide all the essentials that have been revealed by modern research, but also their production is more economical. In other words, they require decidedly less feed per pound of gain in live weight when fed thoroughly efficient rations. Fully as important is the additional fact that certain serious diseases and troubles can be prevented by nutritionally complete rations.

It is therefore highly important that stockmen utilize fully the results of these discoveries, which have nearly all been made by the agricultural experiment stations, the agricultural colleges, and the universities. Unless they take care to feed their stock in a thoroughly efficient, up-to-date manner, they cannot hope to secure maximum net returns.

Fortunately, it is not necessary to go to any unusual expense to meet the usual nutritive needs of most farm animals. Recent research has abundantly shown that good pasture from well-fertilized land and first-class roughage during the winter will usually go far toward meeting all the needs of beef cattle, dairy cattle, sheep, and horses for vitamins and minerals, and will help greatly in meeting their protein requirements. Since swine and poultry eat but relatively little forage, special care must be taken to make sure that they have ample supplies of the minerals and vitamins that may be deficient in ordinary feeds.

Stockmen should do their utmost to feed modern efficient rations. But at all times they should use good judgment, in other words, sound horse sense. They

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should not "fall" for new and unproved theories or succumb to flamboyant but unfounded advertising claims. Some of these claims are expressed in very scientific language, but do not have sound scientific facts behind them.

It is wise to go slow until a new product has been tested by experiment station scientists. In case of doubt as to whether your stock really needs a certain vitamin, mineral, or hormone supplement which may be offered you, it is a good plan to check with your agricultural college and experiment station scientists or with your county agent. They will at all times do their best to give you advice that is not only up-to-date, but also advice that is unprejudiced.

Vitamin A and Carotene

It is now well known that vitaman A is necessary for life and health, even of adult animals. Still larger amounts of the vitamin are needed in growth, in reproduction, and in milk production. A decided deficiency may produce several serious effects.

One of the first symptoms of vitamin A deficiency is night blindness, or failure to see in dim light. This may appear even though the animals are thrifty and are gaining at practically normal rates. Night blindness is followed by nervous disorders, with various degrees of incoordination and spasms. In young animals total and permanent blindness may result from constriction of the optic nerve. In cattle excessive watering of the eyes occurs, and the eyes may become ulcerated. Severe diarrhea is common, and in fattening cattle, generalized edema or swelling, called anasarca, may occur. In breeding animals a serious deficiency may prevent ostrum, or heat, or prevent conception. Deficiency in the pregnant animal may result in abortion or in the birth of dead, weak, or blind offspring.

As a delegate to the European Nutrition Conference, I recently visited the laboratories in London, England, of Sir Edward and Lady May Mellanby of the British Medical Research Council. They have been doing exceedingly interesting work on the effects of vitamin A deficiency, using dogs and rats as test animals. In these studies they have found the reason why the deficiency produces nervous incoordination in growing animals. It is as follows:

As the bones grow, they must not only enlarge on the outside, but the cavities of the bones where nerves pass through, as in the spinal vertebrae, must enlarge. To accomplish this, certain cells, called osteoblasts, lay down bone on the outside.

In serious vitamin A deficiency

there is an actual reversal of these functions. Osteoblasts in the cavities lay down bone inside and actually make the cavities grow smaller. This constricts important nerves, causing the nervous incoordination and spasms. We saw many cases of dogs thus affected. The poor dogs could not run normally, but staggered or ran hopelessly in circles.

All green, actively growing plants are rich in carotene, from which all animals can readily make vitamin A in their bodies. Therefore, when farm animals are on good pasture, they never have any deficiency of the vitamin. This is true even in the case of chickens, which can eat but relatively little forage.

Unfortunately, as grasses and other forage crops mature, the carotene content decreases seriously. When they become dry and weathered in the fall, practically all of the carotene may have been lost. In recent Nebraska studies of various native grasses during the year, the carotene content ranged from 100 to more than 500 parts per million on the dry basis during the most active growth. By November some grasses had lost practically all of their carotene, and the highest content was 60 parts per million.

Because carotene is an unstable substance which is readily destroyed by oxidation, a part disappears when a crop is made into hay by ordinary methods. Much more is preserved when the crop is dehydrated or made into silage.

For example, in extensive Vermont investigations, green hay crops when cut contained on the average 169 parts per million of carotene on the dry basis. More than half of it was lost in the field curing of hay, even in good weather. In poor weather an even heavier loss occurs. After hay had been stored in the mow for six months, it had only about one-sixth as much carotene as did the green plants when cut. After storage for three years the hay had left only one-sixteenth as much carotene as the green plants originally contained.

Dehydrated hay from the same crops had over three times as much carotene after storage for six months as did the field-cured hay. Unfortunately, the cost of dehydrating hay makes it too expensive for general use in stock feeding, except as a special vitamin A supplement.

It was found in these experiments that making the crop into hay-crop silage was nearly as good a method of preserving the carotene as dehydrating it, provided a method was used which made good silage. Such methods are adding molasses, phosphoric acid, or ground grain as a preservative, or also wilting the crop so that the dry matter con-

tent is increased up to 30 to 40 per cent.

It is exceedingly fortunate for stockmen that animals have a large capacity to store Vitamin A in their bodies, chiefly in their livers, when their feed supplies more than their daily needs. Therefore, when farm livestock have been on good pasture throughout the summer, they may be able to store up enough vitamin A to carry them safely through an entire winter period on Vitamin A deficient food.

Texas and other investigations have shown that sorghum silage is considerably lower in carotene than corn silage. If calves are fattened on grain other than yellow corn with sorghum silage as the only roughage, they may show slight symptoms of deficiency before the end of the long fattening period required. Whenever any symptoms of vitamin A deficiency first develop in cattle, the symptoms can be readily cured and further trouble prevented by feeding a little good-quality alfalfa or other legume hay.

Professors Kuhlman and Gallup at the Oklahoma A and M College have done outstanding work on the vitamin A requirements of dairy cattle. They have determined the actual requirements in terms of micrograms of carotene per day. They have also shown clearly that prairie hay of good quality, fed as the only roughage, supplies sufficient carotene for good health, good production, and good reproduction.

Swine probably suffer from vitamin deficiencies more often than cattle or sheep, yet any such troubles can readily be prevented. This can be done by providing good pasture for all swine during as much of the year as possible, and by including a sufficient amount of high-quality alfalfa or other legume hay in the ration when they are not on pasture.

Such hay not only provides abundant carotene, or vitamin A value, but it is also rich in the B-complex vitamins, some of which may be lacking otherwise when swine are not on pasture. Also, if the hay is field-cured, it will furnish vitamin D, as is explained later.

We first proved the importance of legume hay in the rations of pigs not on pasture in our investigations at the University of Wisconsin 25 years ago, before vitamin A was named and before vitamin D had been discovered. Our farmers had what we called "the fall pig problem." Fall pigs often did so poorly, even on the best rations that we college men could recommend, that there was a saying, "if you have an enemy, give him a fall pig."

Dr. McCollom, a discoverer of the vitamin now known as vita-

min A, had found that 5 per cent of good alfalfa hay made a wonderful improvement in his diets for experimental rats. Another experiment station had previously concluded that there was no advantage in adding alfalfa meal to the rations of fattening pigs. However, they had started with well-grown pigs weighing 90 pounds, and had fed too large a proportion of hay. (If a pig has been well grown to a weight of 90 to 100 pounds, he will do well up to market weights on almost any decent ration).

So I thought that if 5 per cent of alfalfa helped rats, it might help fall pigs. Actually, it solved our fall pig problem entirely. On the trio-type supplemental mixture that we developed soon, we could get as good gains on fall pigs as we did with spring pigs on good pasture. This trio mixture was a combination of one-half tankage, meat scraps, or fish meal; one-quarter ground alfalfa hay or other legume hay of excellent quality; and one-quarter plant protein supplement, such as linseed meal, soybean oil meal or cottonseed meal. Such combinations are still among the best that can be used. However, with our present shortage of animal protein supplements, it has been necessary to work out efficient combinations containing less tankage, meat scraps, or fish meal.

Brood sows in winter should receive 10 to 15 per cent of legume hay in their rations. The simplest plan is to feed good alfalfa hay in a rack and let them take all they will. Recent investigations at Wisconsin and Illinois have shown the extreme importance of a liberal amount of legume hay for sows in winter, especially when they receive little or no supplements of animal origin, such as meat scraps.

The studies have also shown that even for growing and fattening pigs it is wise to increase the proportion of legume hay to 10 to 15 per cent when little or no animal protein is fed. The advantage from the larger proportion of legume hay in all probability comes primarily from the increased supply of other vitamins than vitamin A.

Vitamin D

Many investigations have shown that vitamin D is required by farm animals to enable them to assimilate and use the calcium and phosphorus they need for proper bone development. Even mature animals require this vitamin to maintain strong skeletons and prevent bone deterioration. The important question is "Under what practical conditions and for what animals is there apt to be a lack of vitamin D?"

Animals that are exposed to any reasonable amount of sunlight secure a sufficient amount

of the vitamin indirectly from this source. This is because the ultra-violet rays of sunlight convert in the tissues certain substances (known as stereols) into vitamin D. Therefore there is no need of adding a vitamin D supplement to the rations of any farm animal on pasture or which otherwise has considerable exposure to sunlight.

In winter, especially in the northern states, swine may suffer from a lack of vitamin D. However, a deficiency can ordinarily be prevented by including in the ration the proportions of good-quality field-cured legume hay that have been previously stated. Dehydrated hay contains little or no vitamin D. This is because green growing plants have none, and the vitamin D in hay is developed only through the action of the ultra-violet light in sunlight on certain compounds in the plants as life is ceasing in the curing process.

Because of this fact, dehydrated hay cannot serve as a vitamin D supplement in stock feeding, though it is an excellent vitamin A supplement. Therefore, if swine in winter do not have much access to sunlight and are fed dehydrated hay, it is wise to add a vitamin D supplement, such as fish-liver oil or concentrate, or irradiated yeast.

Vitamin B Group of Vitamins

Included under the vitamin B group of vitamins are a whole array of vitamins. Thiamin, riboflavin, niacin or nicotinic acid, pantothenic acid, pyridozine, biotin, choline, and tolic acid have all received considerable study. In addition, some animals require certain other vitamins in this group, such as the grass juice factor, the animal protein factor, bota-pyracin (a vitamin required by poultry), and a vitamin in milk, the discovery of which has just recently been announced by the Bureau of Dairy Industry of the United States department of Agriculture.

Swine need several of the B-complex vitamins, but fortunately when good pasture is provided in the growing season and the rations during the winter are reinforced with high-quality legume hay, these needs are provided for. Investigations by scientists of the United States Department of Agriculture and other studies indicate that the "goose stepping" which sometimes occurs in swine on rather restricted rations may be due to a lack of pantothenic acid.

Extensive experiments in Missouri, Illinois, and Wisconsin show that swine require other vitamins as yet unknown which are supplied by good pasture and high-quality legume hay. Brood sows reproduce much better on restricted rations made up of purified foods when plenty of

alfalfa hay is added, than they do when all the known vitamins are supplied in pure form.

Other Vitamins

Farm animals undoubtedly require vitamin E, the reproductive factor. However, ordinary rations that are otherwise satisfactory commonly supply ample amounts. For example, in a recent New York experiment there was no benefit from adding wheat germ oil as a vitamin E supplement to the ration of dairy bulls used heavily in artificial insemination.

Surprisingly, it has been found in the New York studies on the stiff lamb disease of young lambs, that the trouble can be prevented by feeding wheat germ meal or vitamin E, and even cured by administration of vitamin E.

We do not need to be concerned with vitamin C in stock feeding, since all farm animals synthesize this vitamin in their bodies. It is of interest that any vitamin C which is present in the feed of ruminants is destroyed in the fermentations that occur in the paunch, or rumen.

No occupation is so delightful to me as the culture of the garden. Such a variety of subjects, some one always coming to perfection, the failure of one thing repaired by the success of another, and instead of one thing a continued one thru out the year. Tho an old man, I am but a young gardener.

Thomas Jefferson

Don't Cull Those Broody Hens

Condensed from Everybodys Poultry Magazine

John H. Vondell

During the spring and summer an almost universal problem and nuisance is the broody hen. It has long been a common practice to cage broody hens, but only recently were studies made to learn something about the production characteristics of these birds that go broody. Now we know that this natural trait, inherited from the jungle fowl, is not always unprofitable if we handle the birds right.

Although geneticists have done much to eliminate broodiness and have increased production from 20 to 30 up to over 300 eggs a year in many cases, the urge to hatch a brood of chicks is still found in many production strains. When a hen goes broody she follows the age-old instinct of laying heavily for a few days and then going broody. A study of 15 hens that went broody in June last year showed that the birds averaged 87 per cent production during the two weeks before they went broody. This study at Massachusetts State College points out that it is necessary to place the birds in a broody coop at the first sign of clucking and that when this is done it will take an average of 5.7 days to break them up. Some birds are ready to be released in three days while others take eight days of confinement.

After release from the broody pen it took an average of 6.7 days for birds to get back into production. The minimum was three days and the maximum 13 days. In the latter case, the bird was allowed to stay on the nest five days before being cooped. The average summer production from these 15 birds was 59.2 per cent —July, 60.5 per cent; August, 56.1, and September, 60.9. Ten of the birds went broody twice and three birds went broody three times during this period.

With eggs valued at 45 cents a dozen, feed at $4.00 a 100, and figuring 9 pounds of feed per month, the profit over feed cost was $1.02 per bird for the summer. Since overhead and labor costs would be nearly as high if the birds were culled as when they were kept, almost all of this $1.02 is profit, so broody hens seem to be worth keeping, but they must be banded and kept out of the breeding pens.

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FOR THE FARMER'S LIBRARY

A Living from Bees—By Frank C. Pellett, Field Editor of American Bee Journal. Orange Judd Publishing Co., Inc. $2.25.

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean, School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $3.50.

Bovine Mastitis — A Symposium — Edited by Ralph B. Little, Dept. of Animal and Plant Pathology, The Rockefeller Institute for Medical Research, and Wayne N. Plastridge, Dept. of Animal Diseases, Univ. of Connecticut. McGraw-Hill Book Co., Inc. $7.00.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas. The Interstate Printers & Publishers. $2.50.

Breeds of Livestock in America—By Henry W. Vaughan, formerly Prof. of Animal Husbandry, Iowa State College. College Book Co. $4.75.

Dairy Cattle Feeding and Management—3rd Edition—By H. O. Henderson, Prof. of Dairy Husbandry, W. Va. Univ., Carl W. Larson and Fred S. Putney. John Wiley & Sons, Inc. $4.50.

Dairy Science—By W. E. Petersen, Ph.D., Assoc. Prof. Dairy Husbandry, Univ. of Minn. By R. W. Gregory. J. B. Lippincott Co. $4.00.

Diseases and Parasites of Poultry — By Edgar Hugh Barger, D. V. M., Berkeley, Calif., and L. E. Card, Ph.D., Prof. of Poultry Husbandry, Univ. of Illinois. Lea & Febiger. 3rd Edition. $3.75.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.50.

Farmers of the World—The Development of Agri. Extension—edited by Edmund deS. Brunner, I. T. Sanders, Douglas Ensminger. Columbia Univ. Press (1945). $2.50.

Farm Records—by John A. Hopkins, Ph.D., Asso. Prof. Economics, Iowa State College. Iowa State College Press. $3.00.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $6.00.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. $3.50.

Grow Your Own Fruit—By M. G. Kains, formerly U. S. Dept. of Agri.; Prof.of Horticulture, Penna. State College, Greenberg, Publisher. $3.50.

Hatchery Management — By Roland C. Hartman, Editor, Everybody's Poultry Magazine, and G. S. Vickers, Field Mgr., Ohio Poultry Improvement Asso. Orange Judd Publishing Co., Inc. $4.00.

How to Raise Rabbits for Food and Fur—By Frank G. Ashbrook, Fish and Wildlife Service, U. S. Dept of the Interior. Orange Judd Publishing Co., Inc. $2.00.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $3.00.

Livestock Production—By Walter H. Peters, Chief, Div. of Animal and Poultry Husbandry, Univ. of Minn. McGraw-Hill Book Co., Inc. $4.00.

Livestock Judging Handbook — By Julius E. Nordby and W. Malcolm Beeson, Ph.D., Asst. Professors Animal Husb., Univ. Idaho. The Interstate Printers. $3.25.

Making Pigeons Pay—By Wendell M. Levi, formerly Pigeon Section, U.S.D.A. Signal Corps. Orange Judd Publishing Co., Inc. (1946) $2.50.

Modern Agricultural Mathematics—By Maurice Nadler, B. S., A. M., Dept of Mathematics, Newtown High School, Long Island. Orange Judd Publishing Co., Inc. $2.00.

Modern Farmers' Cyclopedia of Agriculture—By Earley Vernon Wilcox Ph.D., formerly U. S. Dept. of Agri. Orange Judd Pub. Co., Inc. $4.50.

Natural Principles of Land Use—By Edw. H. Graham, Chief of Biology Div., Soil Conservation Service. Oxford University Press. $3.50.

Onion Production—By Donald Comin, Ass't Horticulturist, Ohio State Exp. Station. Orange Judd Publishing Co., Inc. (1946). $2.00.

Pay Dirt—Farming and Gardening with Composts—By J. I. Rodale. Devin-Adair Co. (1945). $3.00.

Pork Production — By William W. Smith, Prof. of Animal Husbandry Purdue Univ. The Macmillan Co. $4.15.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry. Mo. State Univ. J. B. Lippincott Co. $5.00.

Practical Farming for the South — By Benjamin F. Bullock, now Prof. Rural Education, Atlanta Univ. Univ. of North Carolina Press. $2.50.

Profitable Poultry Keeping—By H. Clyde Knandel, Head, Dept. Poultry Husb., Penn State College. Orange Judd Publishing Co., Inc. $3.00.

Repairing Farm Machinery—By Ivan G. Morrison, Asst. Professor Agri. Education, Purdue Univ. The Interstate Printers & Publishers. $2.25.

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Book Co., Inc. $4.50.

Soil Conservation—By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Dept. of Agric. McGraw-Hill Book Co., Inc. $6.50.

Starting Right with Turkeys—By G. T. Klein, Extension Poultryman, Mass. State College; edited by Ed. Robinson. The Macmillan Co. (1946). $2.50.

Successful Poultry Management—By Morley A. Jull, Professor and Head of Poultry Dept., Univ. of Maryland. McGraw-Hill Book Co., Inc. $3.50.

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LILIES FOR EVERY GARDEN—by Isabelle Preston, Assistant, Ornamental Plant Breeding, Central Experimental Farm, Ottawa, Canada.

The amateur gardener who wishes to grow lilies will find Miss Preston's book a valuable guide. It is written simply and includes a number of plates of many lily varieties. Careful and concise directions are given on where to plant the lily, its cultivation, propagation, and hybridization. The book treats of insects and other pests of lilies and their control as well as lily diseases and methods of prevention and control. A discussion of varieties which may be grown in pots and their cultural requirements is included in the text, and a list of varieties with descriptive notes.
Publisher: Orange Judd Publishing Co., Inc. 157 pages 1947 $2.00

ALL ABOUT HOUSE PLANTS—by Montague Free, Staff Horticulturist, Home Garden Magazine, formerly Horticulturist, Brooklyn Botanic Garden.

The title of this book, "All About House Plants" and its subtitle, "Their Selection, Culture and Propagation, and How Best to Use Them for Decorative Effect" is a good synopsis of the book's contents. It is a remarkably complete volume giving minute instructions on all aspects of the culture of house plants. It contains many pictorial directions for the care of plants, a large number of colored plates and line drawings, and lists of plants for special situations and those requiring special care. The volume is well indexed and quite readable.
Publishers: The American Garden Guild, Inc., and Doubleday & Co., Inc. 304 pages 1946 $3.50

AMERICA'S GARDEN BOOK—by Louise Bush-Brown, Director of the School of Horticulture and James Bush-Brown, Member of the American Society of Landscape Architects.

This is a book of gardening information which is an excellent guide for every operation related to the garden. Among its many chapters are those on soils, garden design, construction problems, lawns, plant materials, plant diseases, types of gardens. It can be considered a source book for all gardening knowledge. The material is ably presented, amply illustrated, and well indexed.
Publisher: Charles Scribner's Sons 1180 pages $3.50

RAISING LIVESTOCK—by Walter H. Peters, Chief, Div. of Animal and Poultry Husbandry, Univ. of Minn. and George P. Deyoe, Prof. of Education, Mich. State College. McGraw-Hill Book Co., Inc. $3.50.

DOMESTIC GEESE AND DUCKS—by Paul P. Ives, Pres. Am. Waterfowl Ass'n. Orange Judd Publishing Co., Inc. $3.50.

RAISING TURKEYS, DUCKS, GEESE, GAME BIRDS—by Morley A. Jull, Prof. and Head of Poultry Dept., Univ. of Md. McGraw-Hill Book Co., Inc. $3.75.

ELEMENTS OF SOIL CONSERVATION—by Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Dept. Agric. McGraw-Hill Book Co., Inc. $3.20.

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Cicero